

Community Assistantship Program

...a program of the Center for Urban and Regional Affairs (CURA)

Crow Wing County's Lakeshore Impervious Coverage Research Project Phase II

Prepared in partnership with
Crow Wing County

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2012

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Crow Wing County's Lakeshore Impervious Coverage Research Project

Phase II-Fall 2012

I. Executive Summary

The purpose of the 2012 impervious coverage research project was to determine the amount of impervious surfaces on lakeshore parcels for parcels on lakes 500-1000 acres in size. The percent impervious was calculated for the entire riparian lot. The percent impervious was also calculated within 250 feet and 500 feet of the riparian lot. The percent of impervious surfaces was calculated using high resolution Lidar and aerial photography in ESRI's ArcMap software.

The final product of the impervious coverage study is a comprehensive Geographic Information System (GIS) layer of different surfaces and a calculation of the percent impervious by parcel on the selected lakes. This will help Crow Wing County in its water planning efforts, especially in regards to the effects of stormwater management. It will also help with determining what land use performance standards may be needed for future permit applicants.

II. Purpose

Water is Crow Wing County's lifeblood. The county has an area of 731,000 acres and approximately 102,000 acres or 14% is covered by over 400 scenic lakes, rivers, and streams. An additional 14% is covered by wetlands as well. The abundance of surface water makes this Central Minnesota County an attraction to people.

From 1990 to 2000 the population in Crow Wing County has increased by 24.5%, the eleventh fastest growth county of Minnesota's 87. The most recent census shows the population continued to grow another 13.4% from 2000 to 2010. The majority of the growth is concentrated around the clear, deep water lakes where seasonal cabins are being replaced with larger year-round homes. With these larger homes comes the potential for more stormwater runoff into these majestic lakes.

Crow Wing County revised its Land Use Ordinance in 2011. This ordinance placed added performance standards based on the amount of impervious surfaces per lot. It is now required to

have a storm water management plan if the riparian lot exceeds 15% in impervious surfaces. The ordinance prohibits more than 25% impervious surfaces in the shoreland protection zone (Article 41). This ordinance will help keep lakes clean for generations to come.

Table 41.1 Shoreland Protection Zone Impervious Surface Limits

Development or Use	Maximum Impervious Surface	Applicable Area
Residential lots-with no stormwater plan required as per Article 41.2 1 A	15%	Total lot area above the OHW
Residential lots with stormwater plan as per Article 41.2 1 B	20%	Total lot area above the OHW
Residential lots with stormwater plan & shoreline buffer as per Article 41.2 1 C	25%	Total lot area above the OHW
Conservation Developments with stormwater plans as per Article 41.3	30%	Average Dwelling unit lot above the OHW
Resorts with stormwater plans as per Article 34.8	25%	Total project area and any tier above the OHW
Commercial with stormwater plans as per Article 16.3	30%	Total lot area above the OHW

This study defines the percent of impervious surfaces on individual lots. It is needed to maintain the integrity and build the foundation for future studies. We as individuals need to realize that our planning today will make a huge impact on the future. It does not take long to damage our natural resources, such as these waterways and lakes, but it will take generations to get them back to the way they are today.

III. Process

This Phase II study is a continuation of a project I previously worked on with staff from the Crow Wing County Land Services Department. The information needed was the amount of impervious surfaces within 500 feet of the Ordinary High Water. They wanted to know the different kinds of impervious surfaces such as bituminous driveways, gravel driveways, dirt driveways, grass driveways, boathouses, dwellings, sheds, garages, patios, and so on. This information will help determine future updates to the local water plan.

Using ArcMap, I created different layers for all the different kinds of impervious surfaces and began digitizing them. Layers are used to display and work with a specific GIS dataset. A layer in ArcMap represents geographical data such as a particular theme and in this case it is the impervious surfaces. In certain instances, it was impossible to see the entire building on the

aerial photo. In these instances I had to use county records to find out the dimensions of the structure. The Property Valuation and Classification Office has records on all the structures in the county. Using this information I could determine the percent of impervious per lot.

A calculation change specific to ^Planned Unit Developments (PUD's) will also be implemented. Previously, we calculated the impervious surface areas for each unit or lot within a PUD. The new calculation will total the impervious surface areas within the entire PUD, rather than as individual parts (an example is included in the appendices).

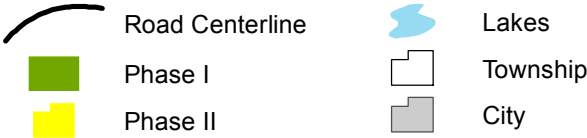
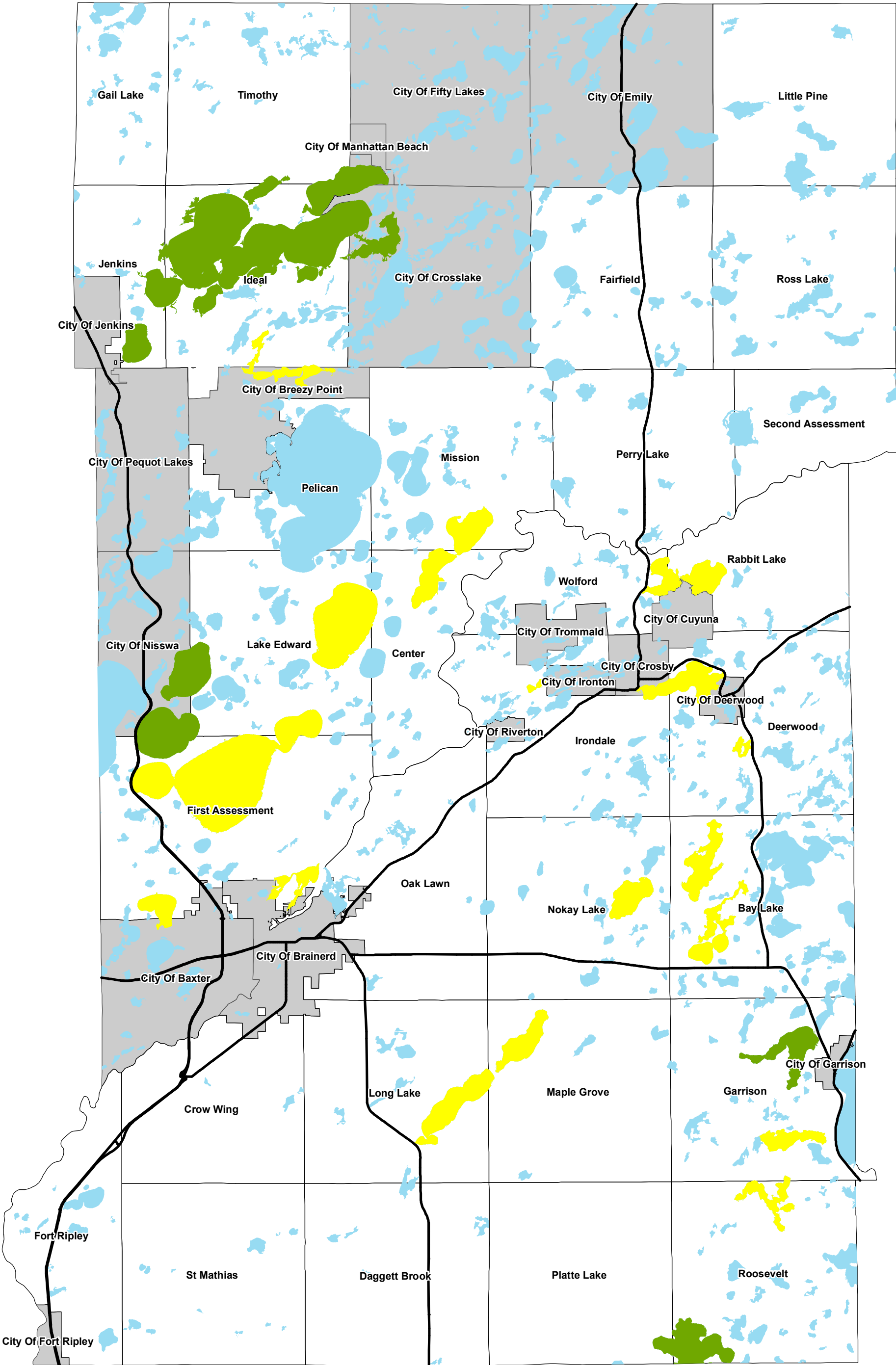
V. Appendices

Lake Name	# of Riparian Lots Per Lake	% Imp Within 250' of OHW	% Imp Within 500' of OHW	% Total Impervious of all lots
Camp	226	4.2%	4.4%	3.4%
Clearwater**	104	3.3%	3.8%	2.7%
Crooked	317	5.1%	5.4%	4.8%
Edward	288	3.8%	8.1%	6.0%
Gilbert**	144	3.8%	3.8%	3.5%
Hanks	129	3.9%	4.9%	4.4%
Lower Mission	130	0.8%	2.1%	2.2%
Nokay	83	2.2%	4.0%	3.1%
North Long	735	6.5%	8.8%	6.2%
Ossawinnamakee**	242	6.9%	8.3%	7.6%
Portage	72	9.9%	8.6%	6.4%
Rabbit**	236	7.1%	8.1%	6.5%
Red Sand**	91	7.5%	6.9%	4.8%
Serpent**	278	15.4%	15.9%	14.5%
Smith	128	3.0%	2.9%	2.2%
South Long	431	8.4%	8.2%	5.7%
Upper Mission	159	3.3%	6.1%	5.2%
Upper South Long	304	9.9%	10.1%	7.1%

** Some parcels not included because they are located inside city limits.

^A "Planned unit development" means a type of development characterized by a unified site design for a number of dwelling units or dwelling sites on a parcel, whether for sale, rent, or lease, and also usually involving clustering of these units or sites to provide areas of common open space, density increases, and a mix of structure types and land uses. These developments may be organized and operated as condominiums, time-share condominiums, cooperatives, full fee ownership, commercial enterprises, or any combination of these, or cluster subdivisions of dwelling units, residential condominiums, townhouses, apartment buildings, campgrounds, recreational vehicle parks, resorts, hotels, motels, and conversions of structures and land uses to these uses.
61250.2500 Subp.12, Minnesota Administrative Rules

Phase I Overview Map



2010 Fall Imagery

South Long
(18-136 P)
GD

ARTHUR DR

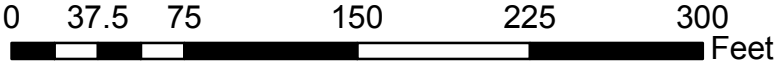
LINDROTH LN

MEADOW BROOK LN

18

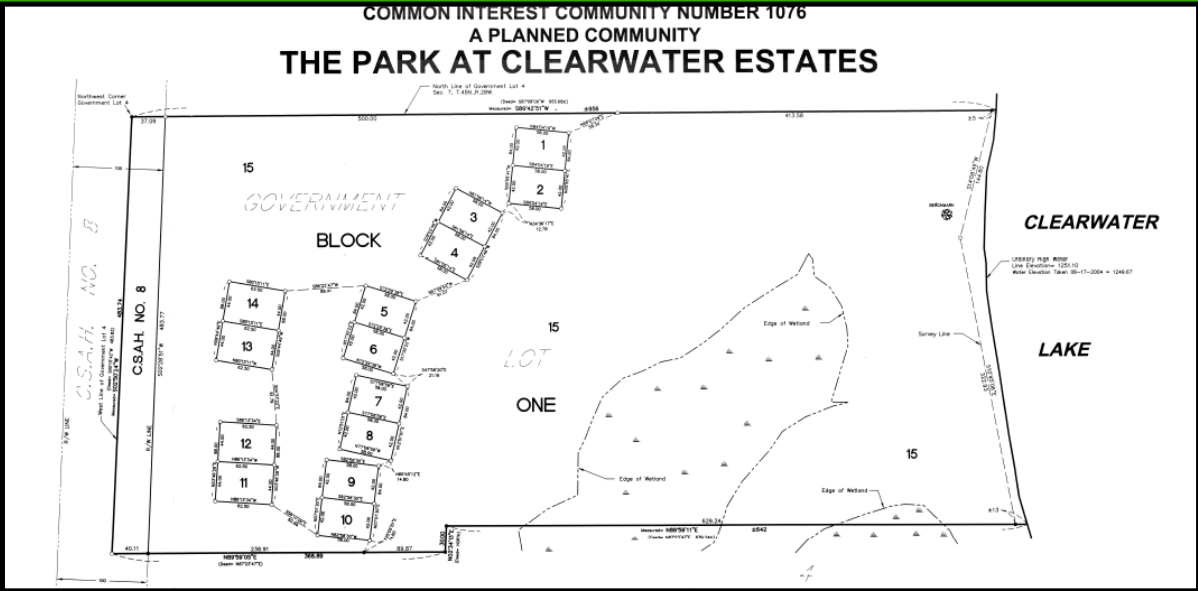
Impervious Surface Types

This data is provided on an "AS-IS" basis, without warranty of any type, expressed or implied, including but not limited to any warranty as to their performance, merchantability, or fitness for any particular purpose.



- | | | |
|---------|-------------------------|-------------------|
| Roads | Boathouse | Garage |
| Lakes | Driveway-Cement/Asphalt | Miscellaneous |
| Parcels | Driveway-Dirt/Gravel | Patio/Landscaping |
| | Driveway-Grass | Shed |
| | Dwelling | |

Before

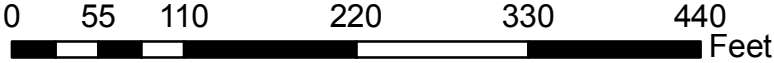


After

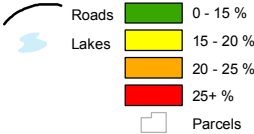


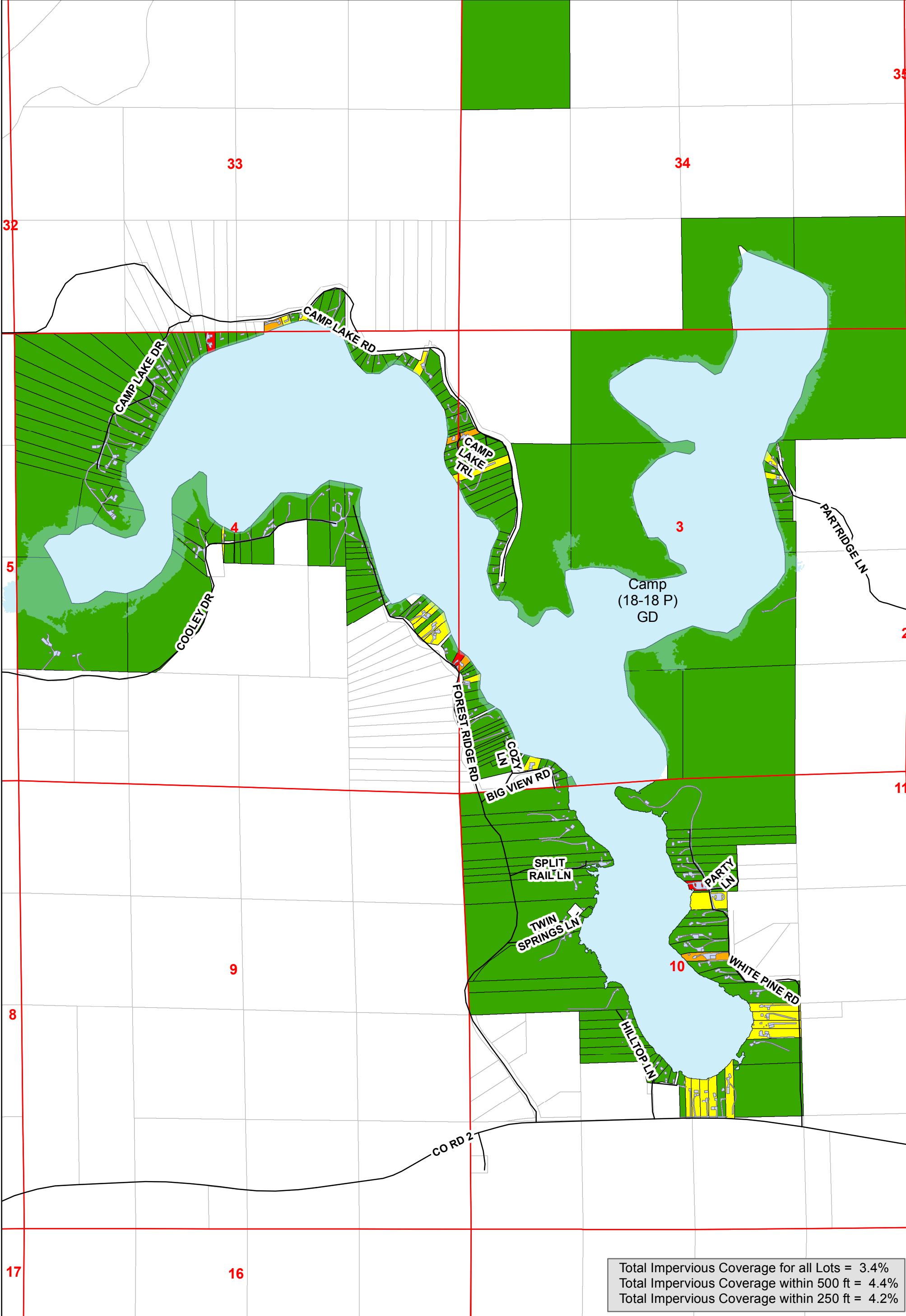
Impervious Calculations on
Planned Unit Development (PUD)
on Clearwater Lake

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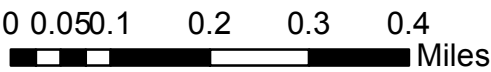
Impervious % within 250 ft of Shoreline





Total Impervious Coverage for all Lots = 3.4%
Total Impervious Coverage within 500 ft = 4.4%
Total Impervious Coverage within 250 ft = 4.2%

Camp Lake

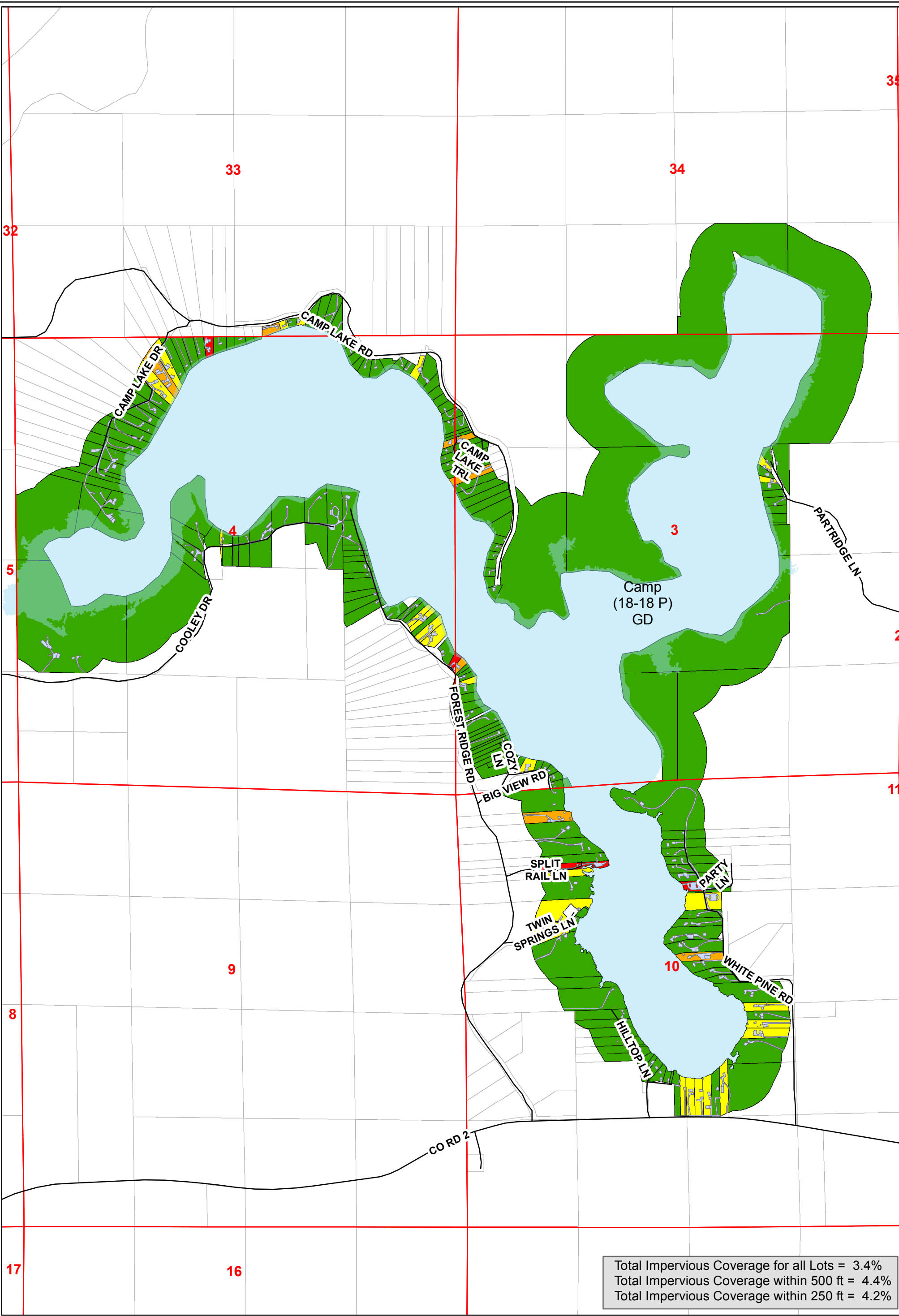


Impervious Surface Coverage by Parcel

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |

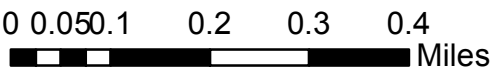
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Total Impervious Coverage for all Lots = 3.4%
Total Impervious Coverage within 500 ft = 4.4%
Total Impervious Coverage within 250 ft = 4.2%

Camp Lake

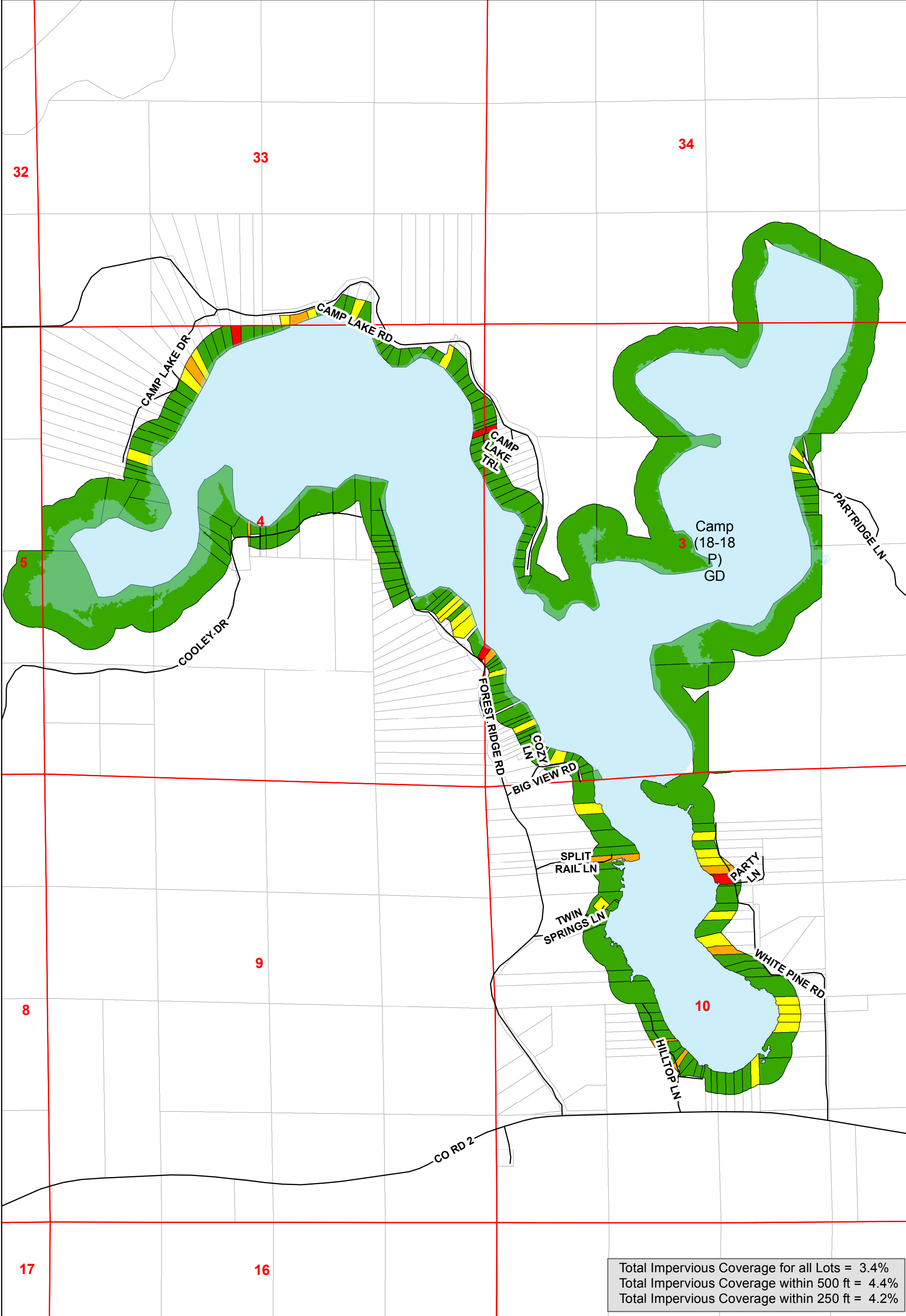


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Impervious % within 500 ft of Shoreline

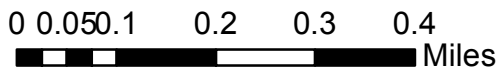
- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |



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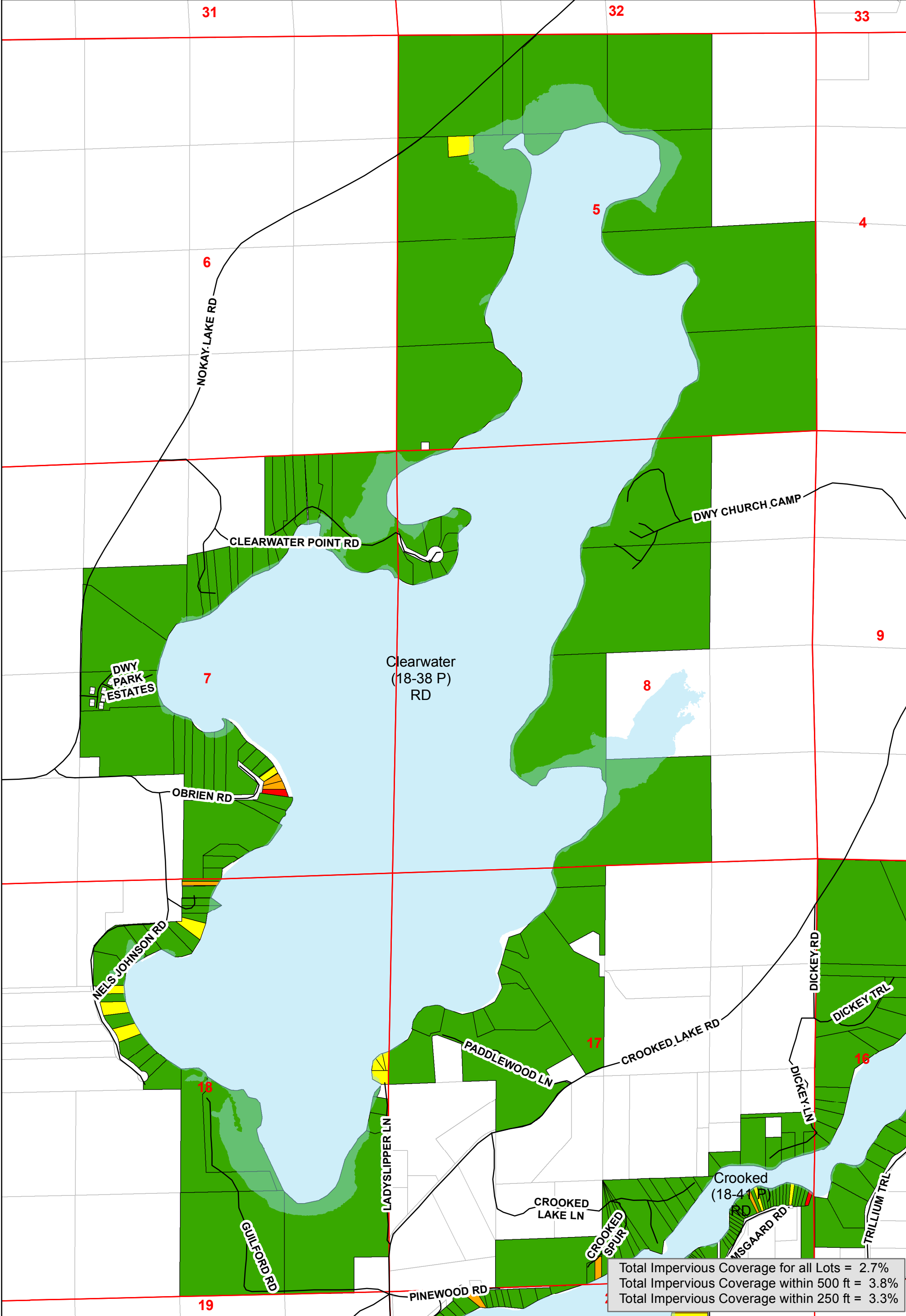
Camp Lake



Impervious % within 250 ft of Shoreline

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |

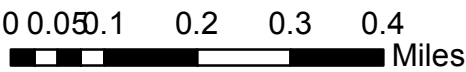




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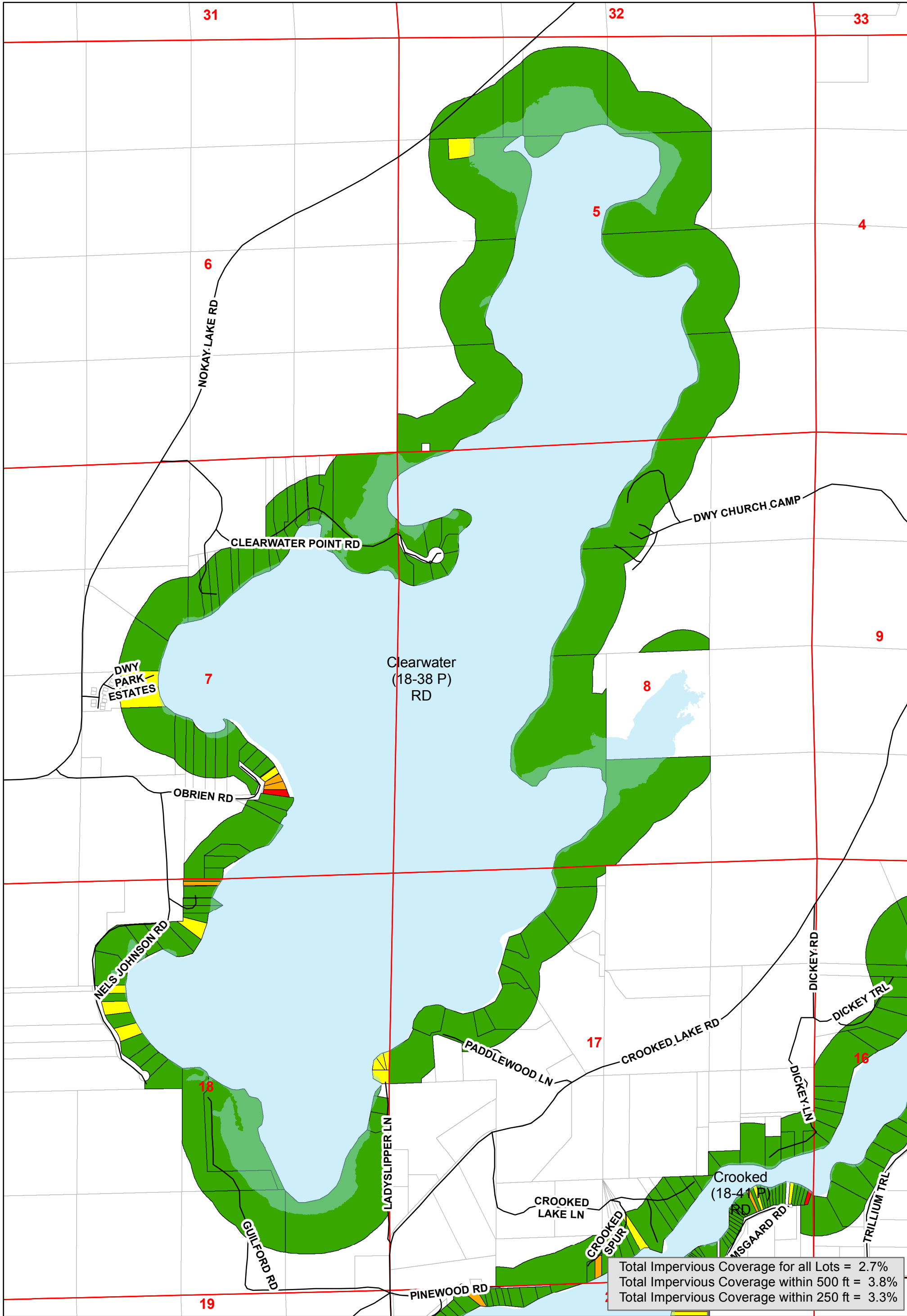
Clearwater Lake



Impervious Surface Coverage by Parcel

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |

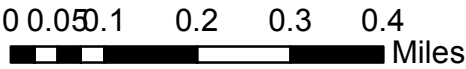




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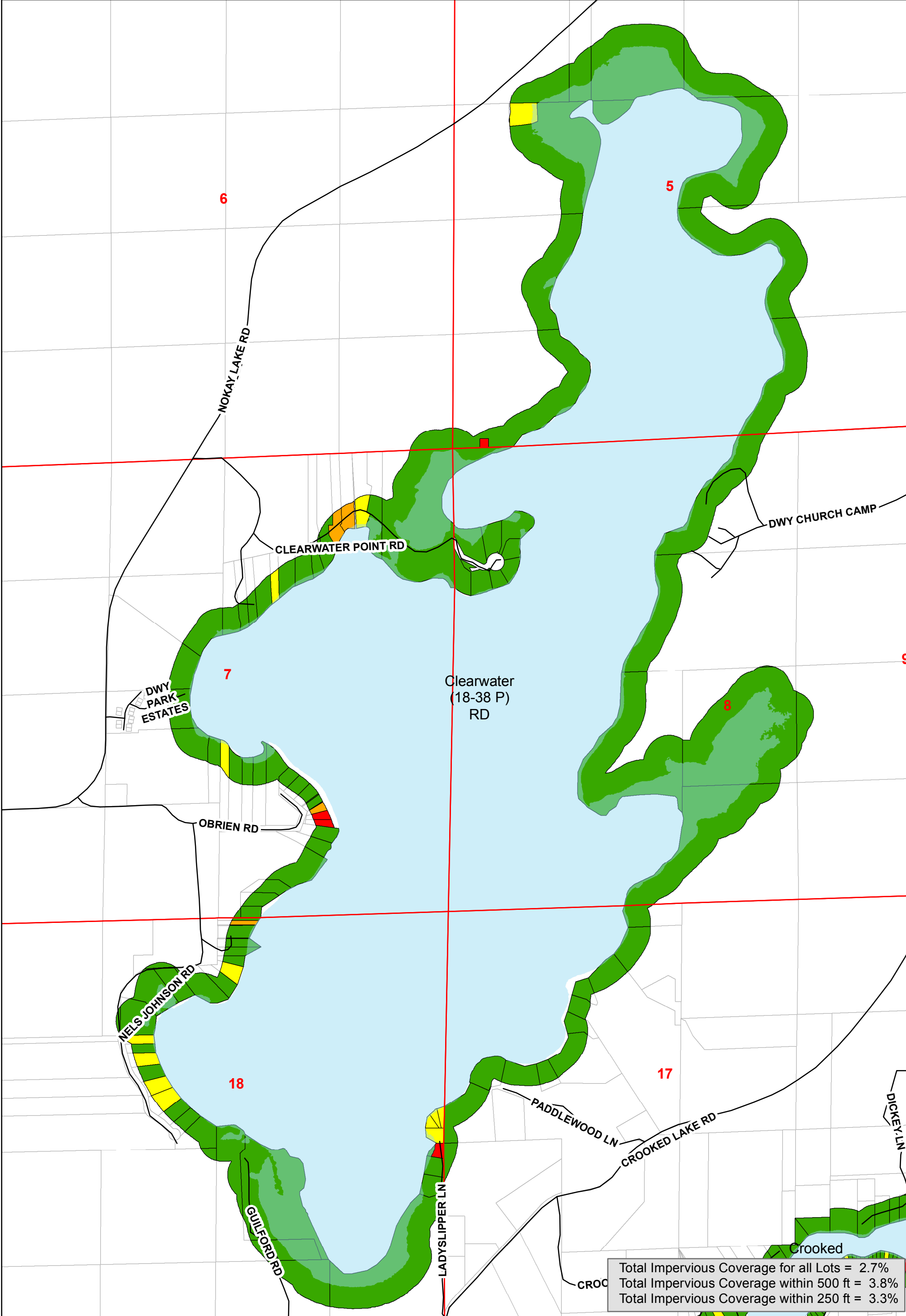
Clearwater Lake



Impervious % within 500 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |





Total Impervious Coverage for all Lots = 2.7%
Total Impervious Coverage within 500 ft = 3.8%
Total Impervious Coverage within 250 ft = 3.3%

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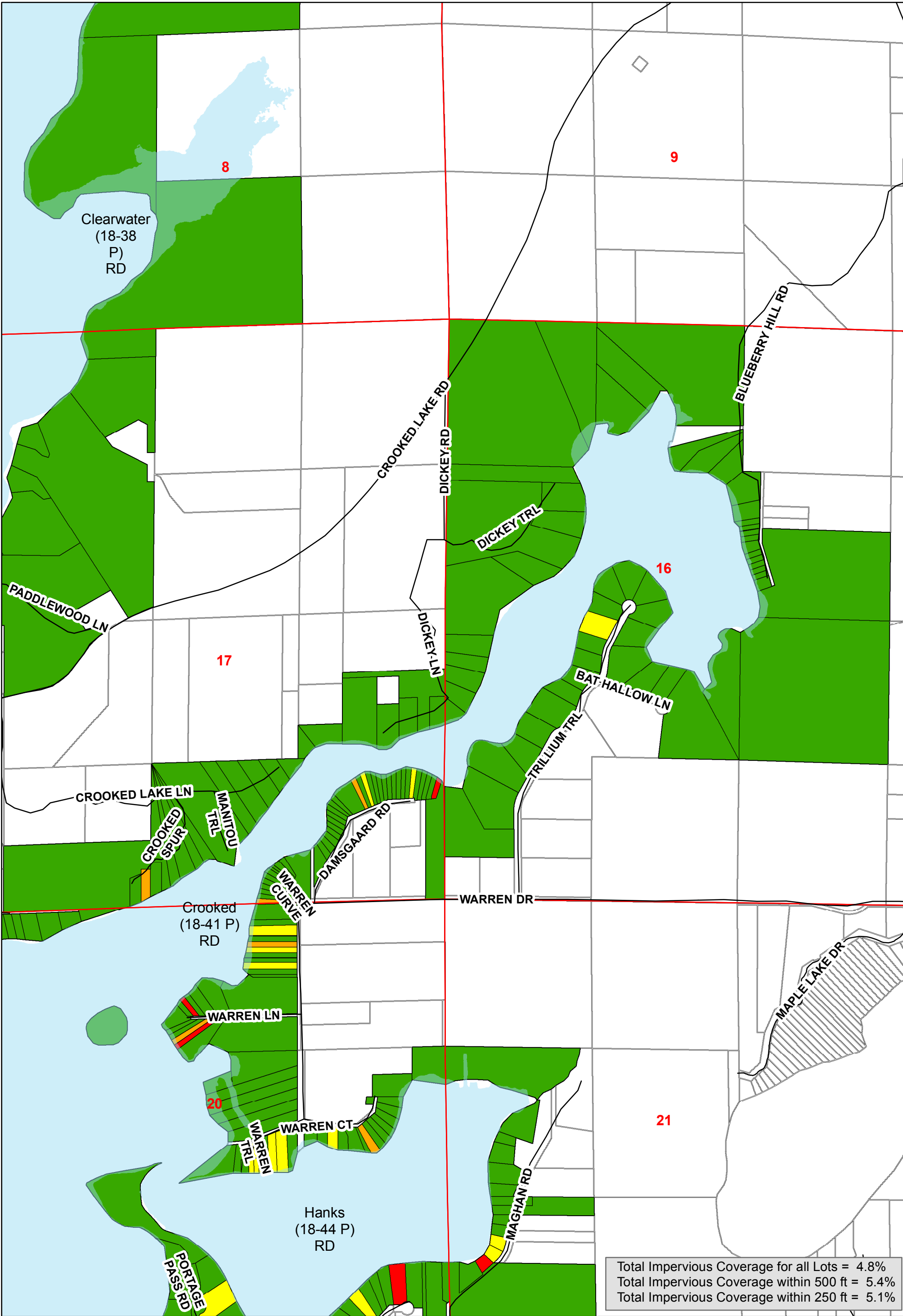
Clearwater Lake

0 0.050.1 0.2 0.3 0.4
Miles

Impervious % within 250 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |





Crooked Lake (North)

Impervious Surface Coverage by Parcel

- Roads
- Section Lines
- City
- Parcels
- Lakes
- 0 - 15 %
- 15 - 20 %
- 20 - 25 %
- 25+ %

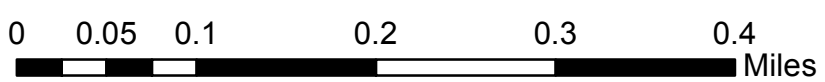
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0 0.05 0.1 0.2 0.3 0.4 Miles



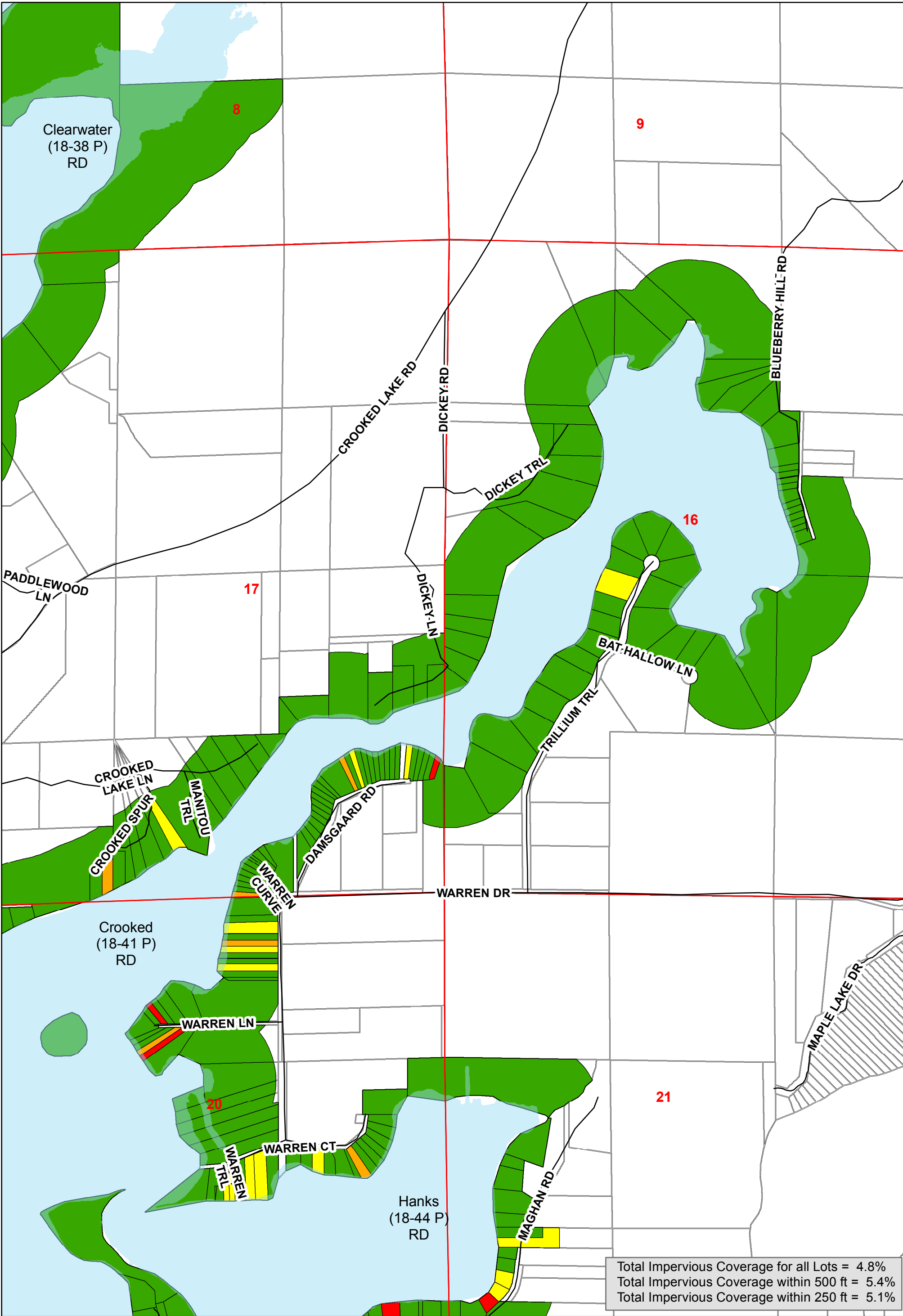
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Crooked Lake (South)

Impervious Surface Coverage by Parcel

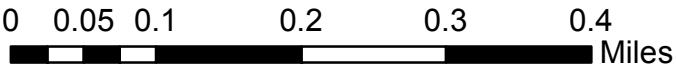
- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |



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Crooked Lake (North)



Impervious % within 500 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |



CROW WING COUNTY



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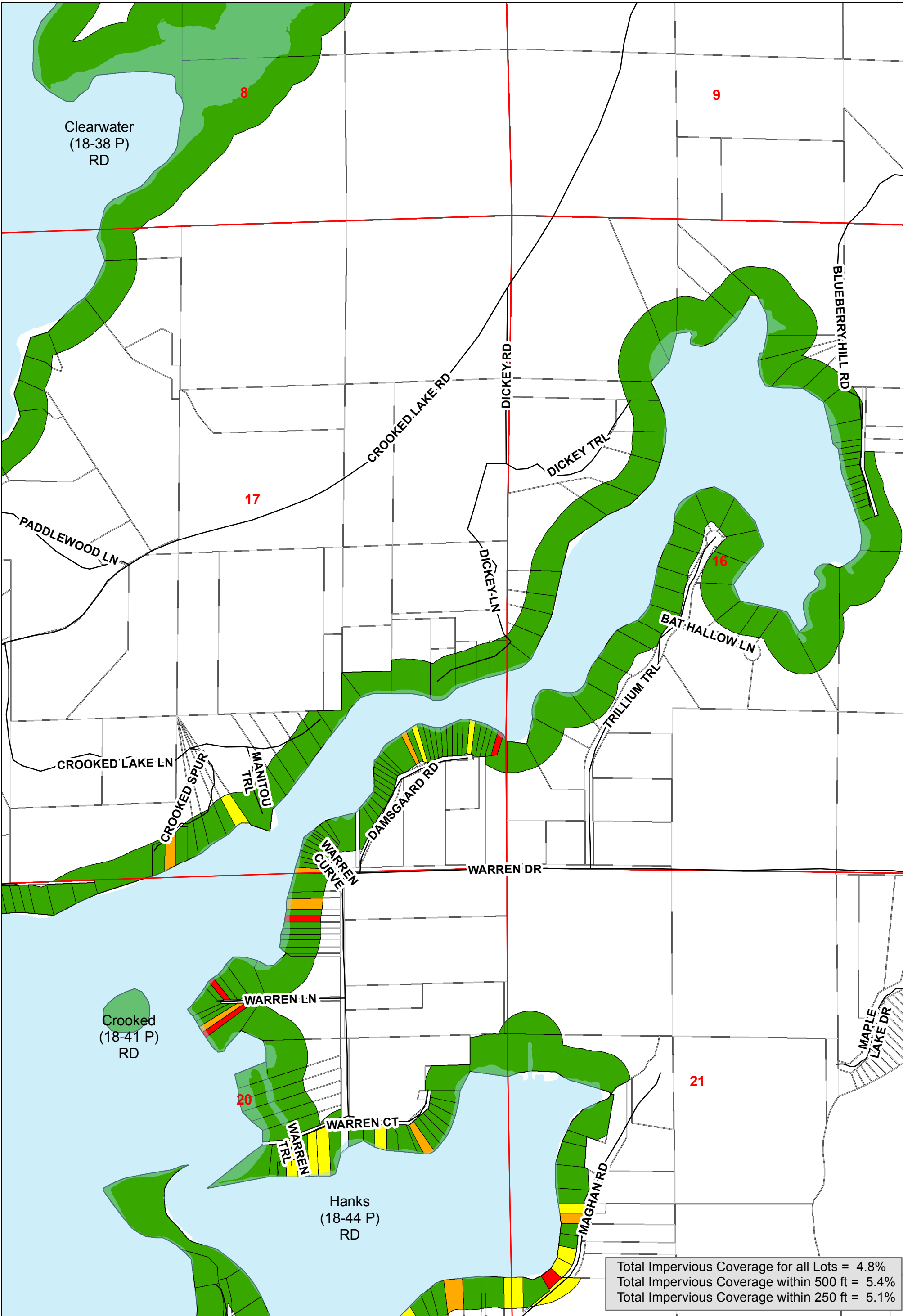


CROW WING COUNTY

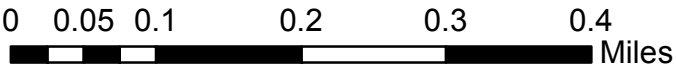


Crooked Lake (South)

0 0.05 0.1 0.2 0.3 0.4 Miles



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Crooked Lake (North)

Impervious % within 250 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |



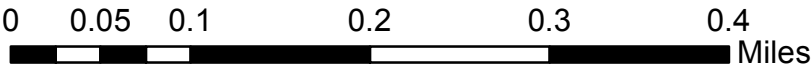
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CROW WING COUNTY

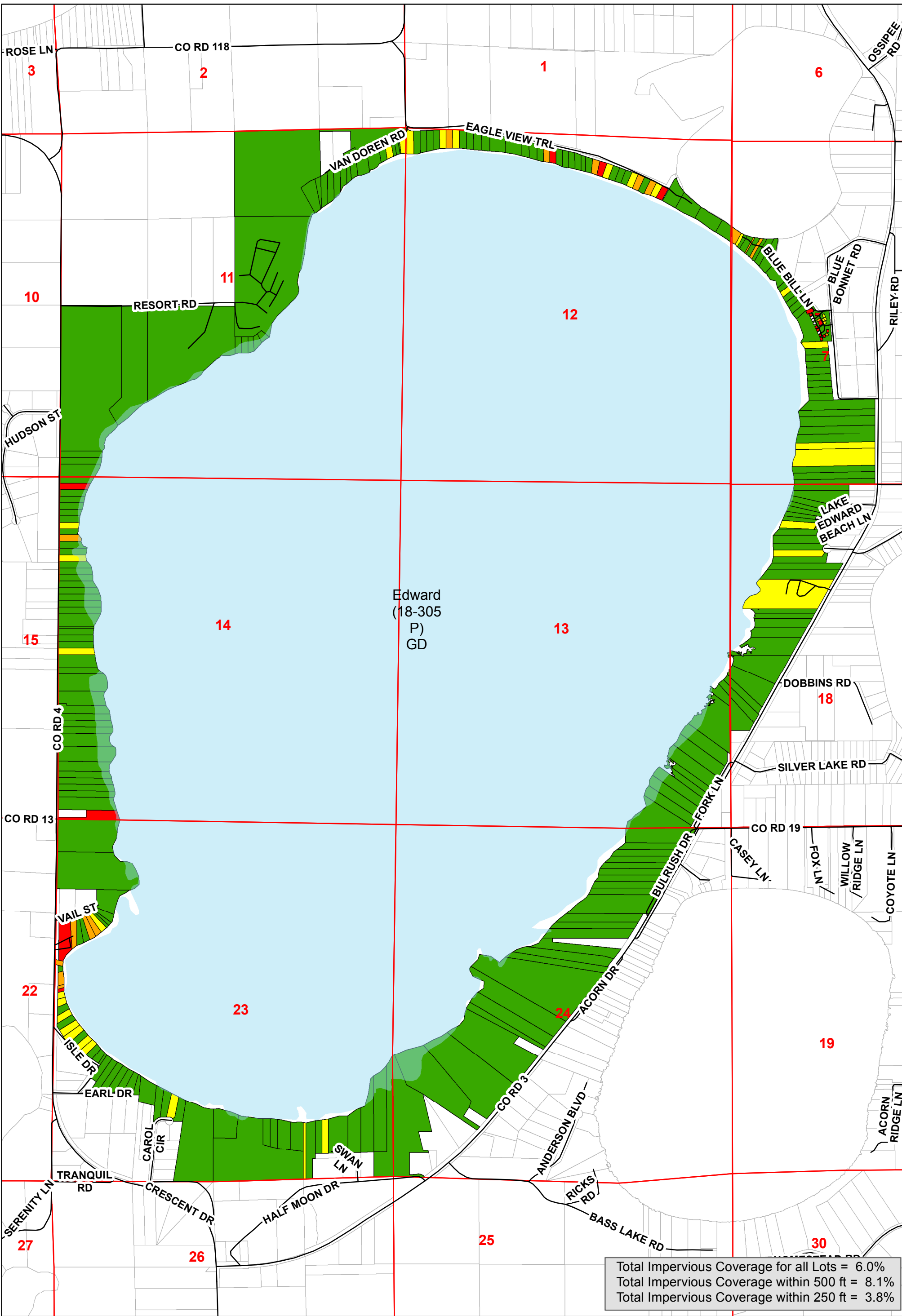


Crooked Lake (South)

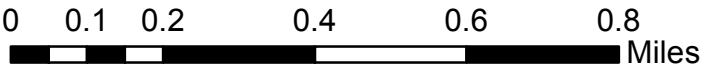


Impervious % within 250 ft of Shoreline





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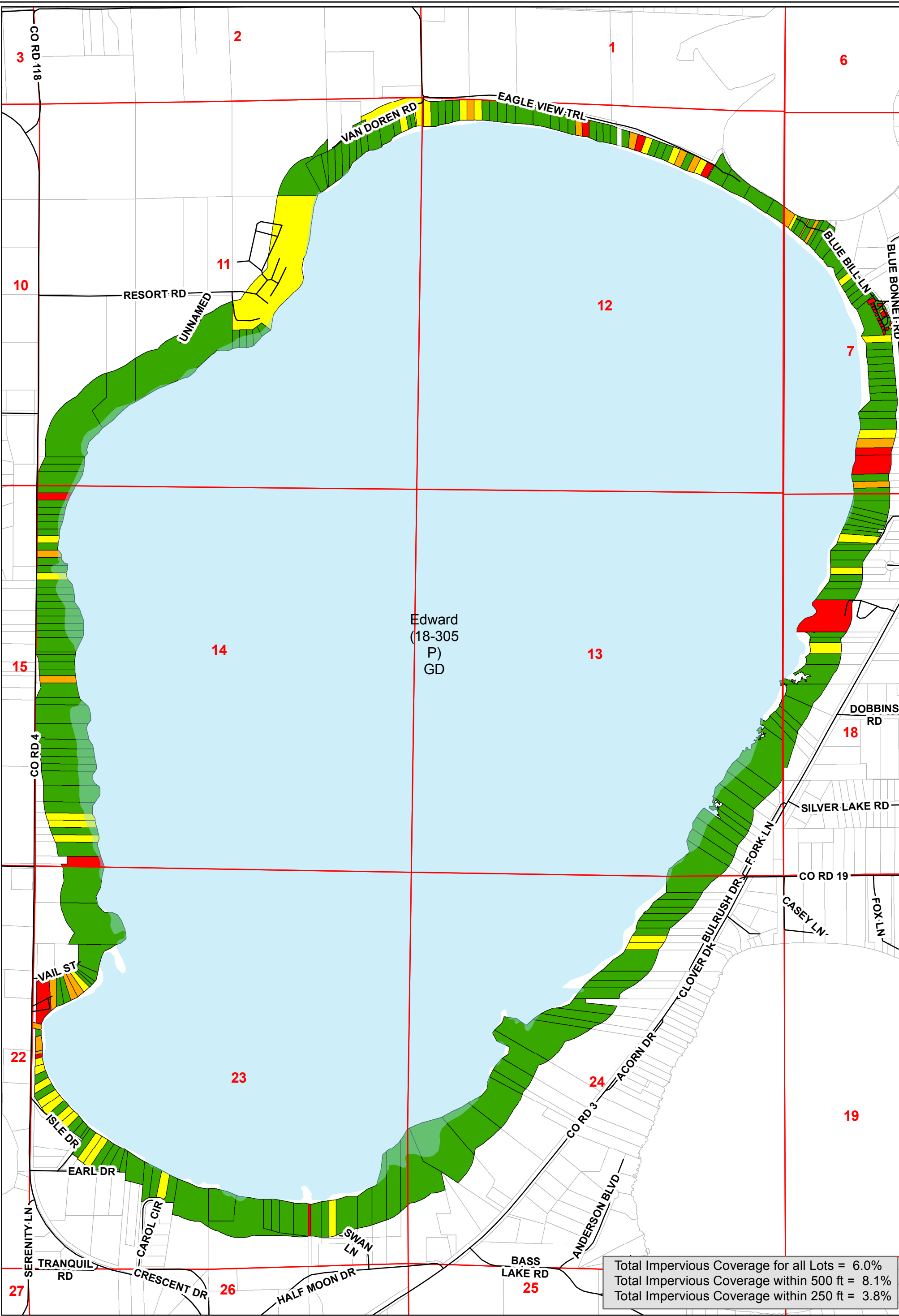


Lake Edward

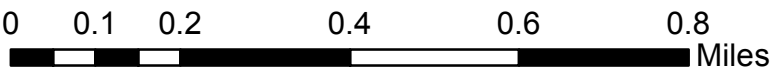
Impervious Surface Coverage by Parcel

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |





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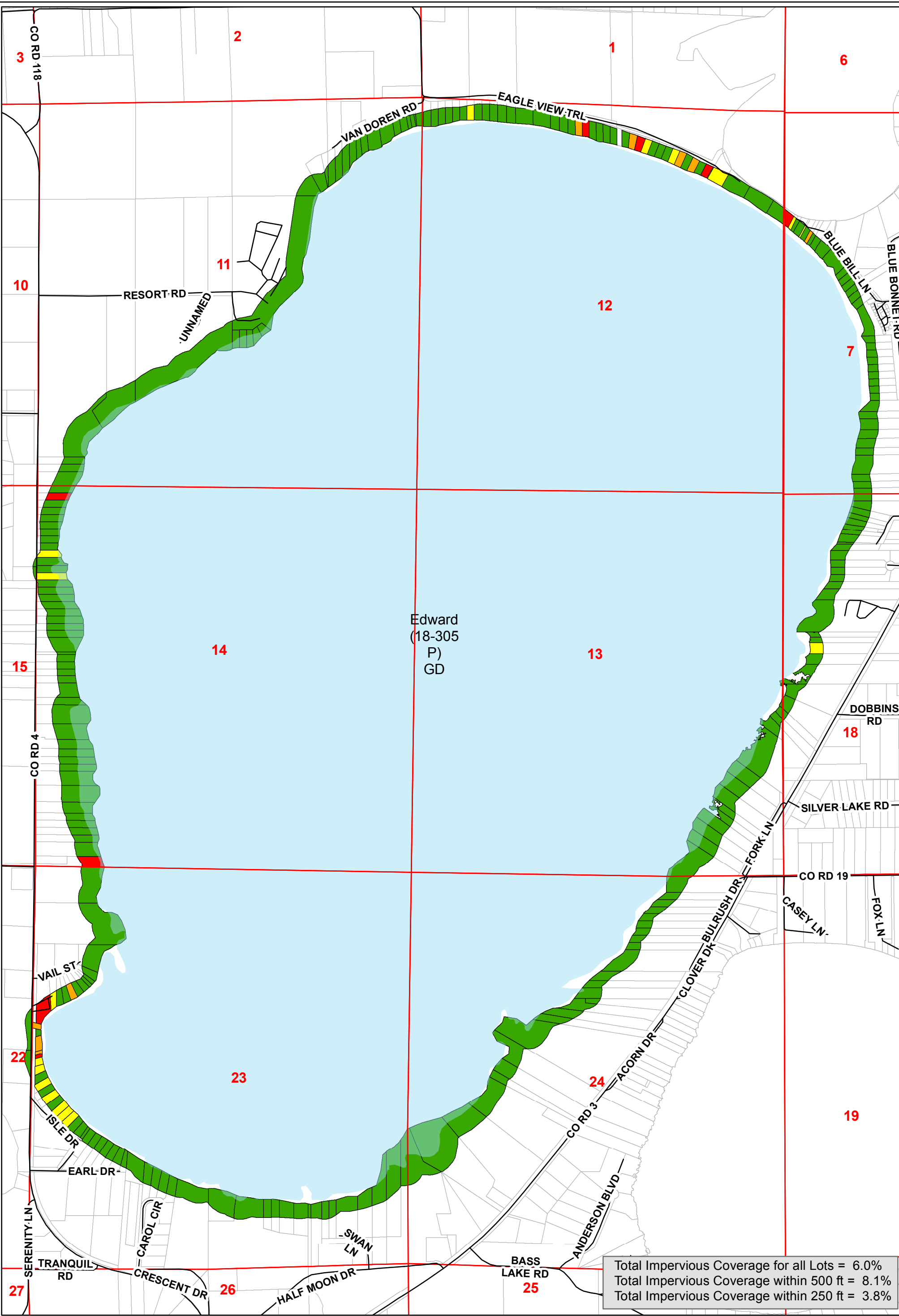


Lake Edward

Impervious % within 500 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |



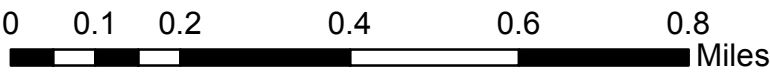


Total Impervious Coverage for all Lots = 6.0%
Total Impervious Coverage within 500 ft = 8.1%
Total Impervious Coverage within 250 ft = 3.8%

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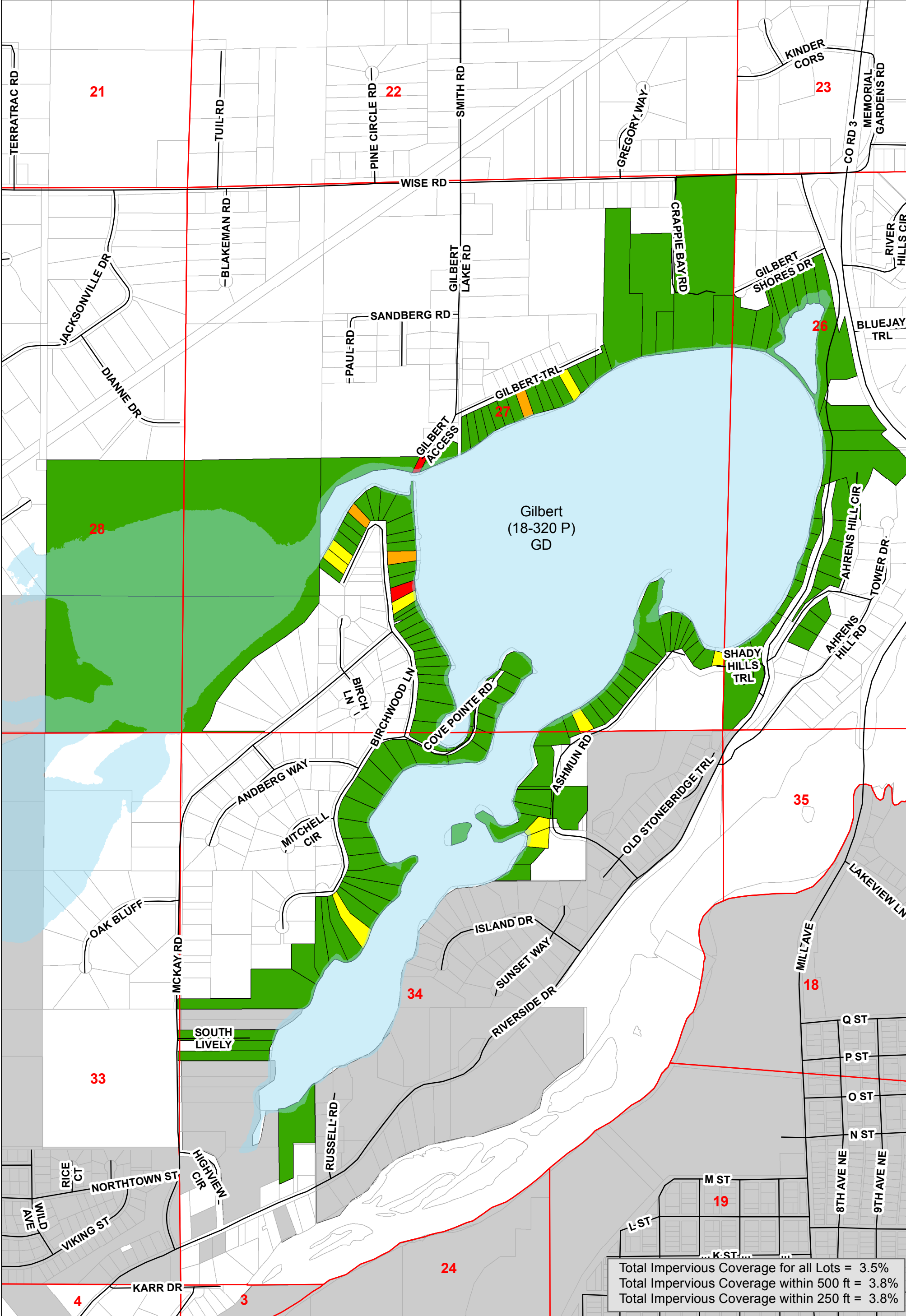
Lake Edward



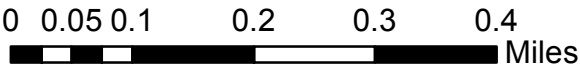
Impervious % within 250 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |





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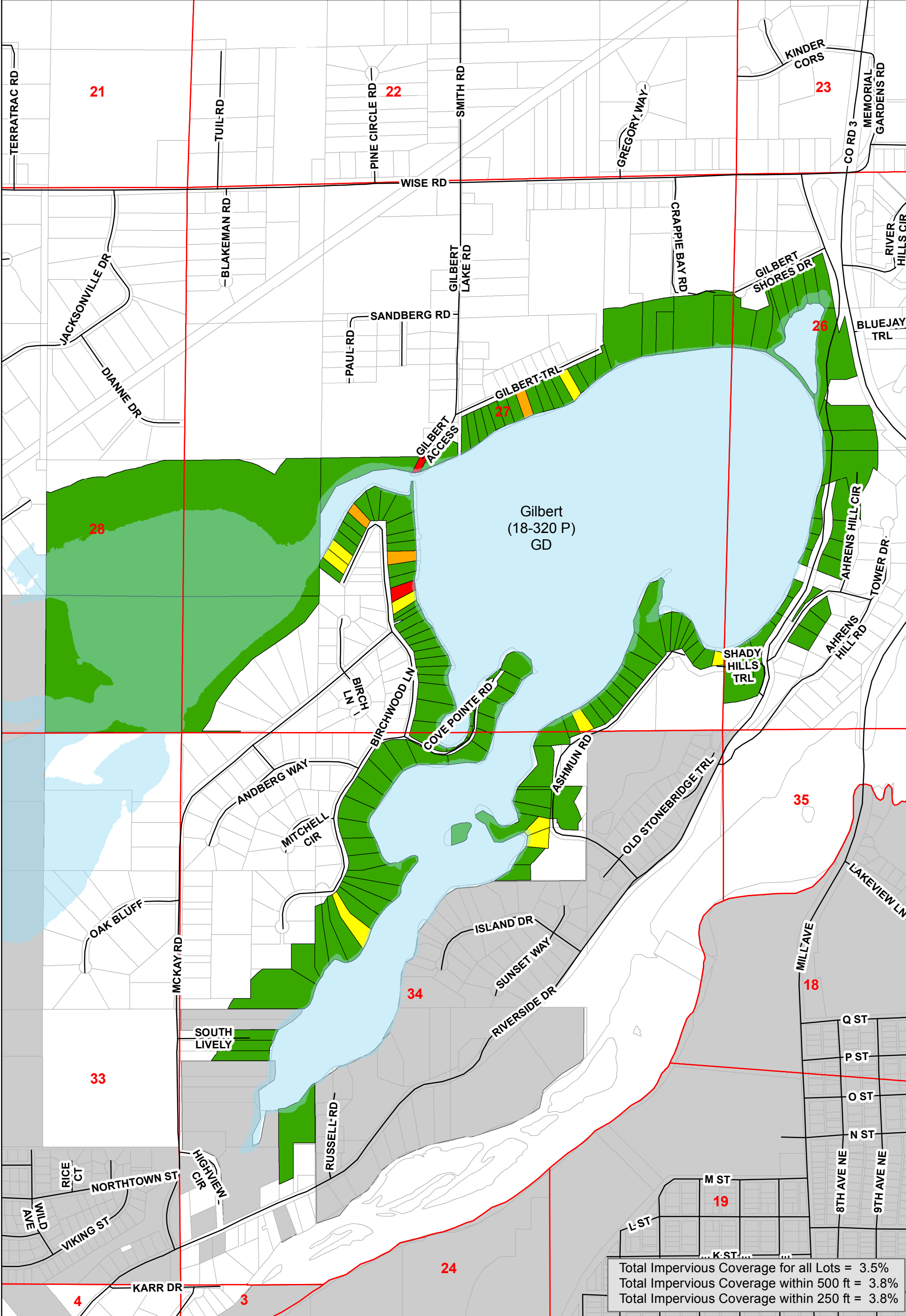


Gilbert Lake

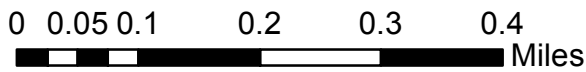
Impervious Surface Coverage by Parcel

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |





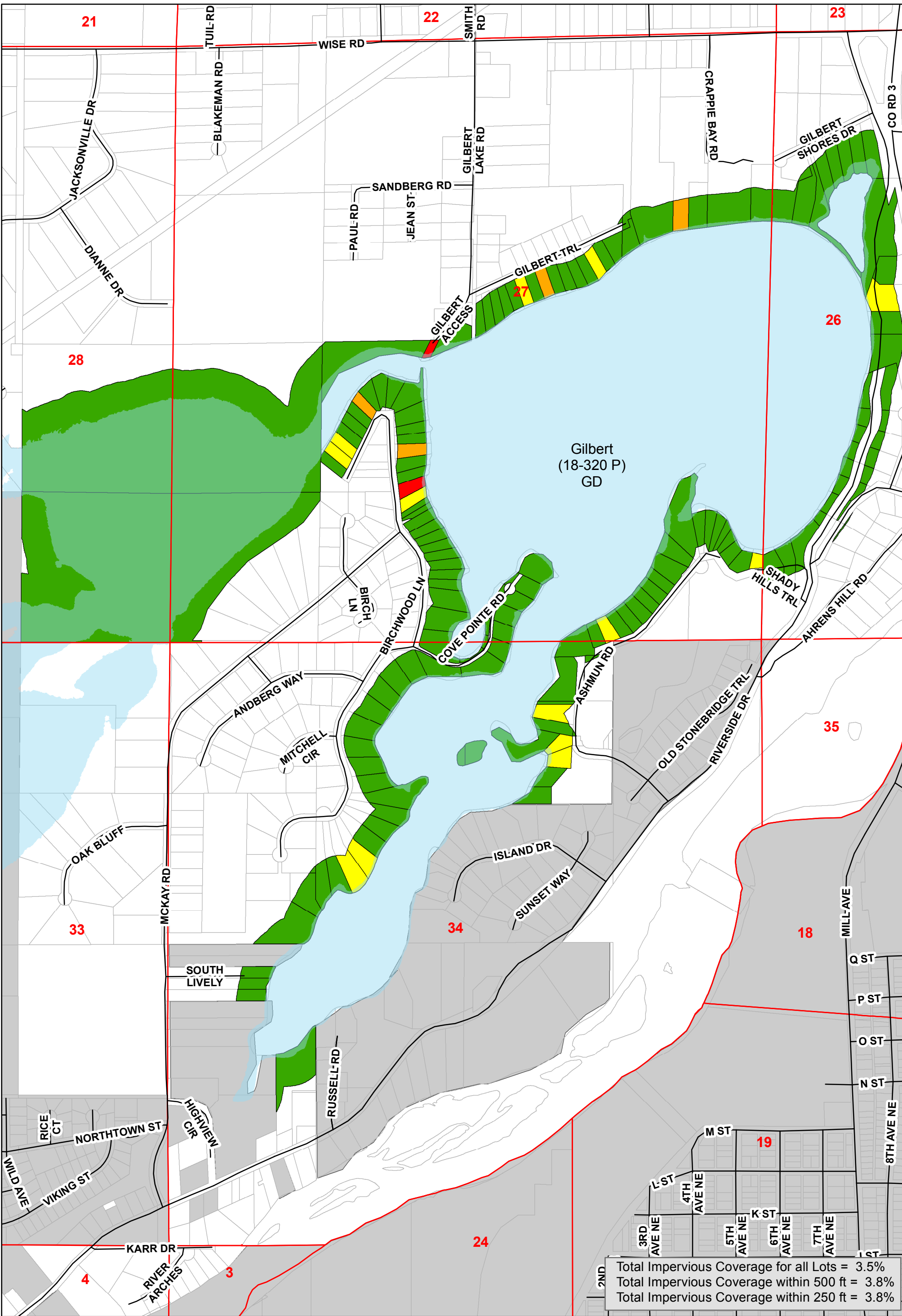
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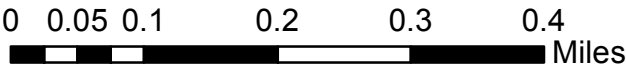
Gilbert Lake

Impervious % within 500 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |



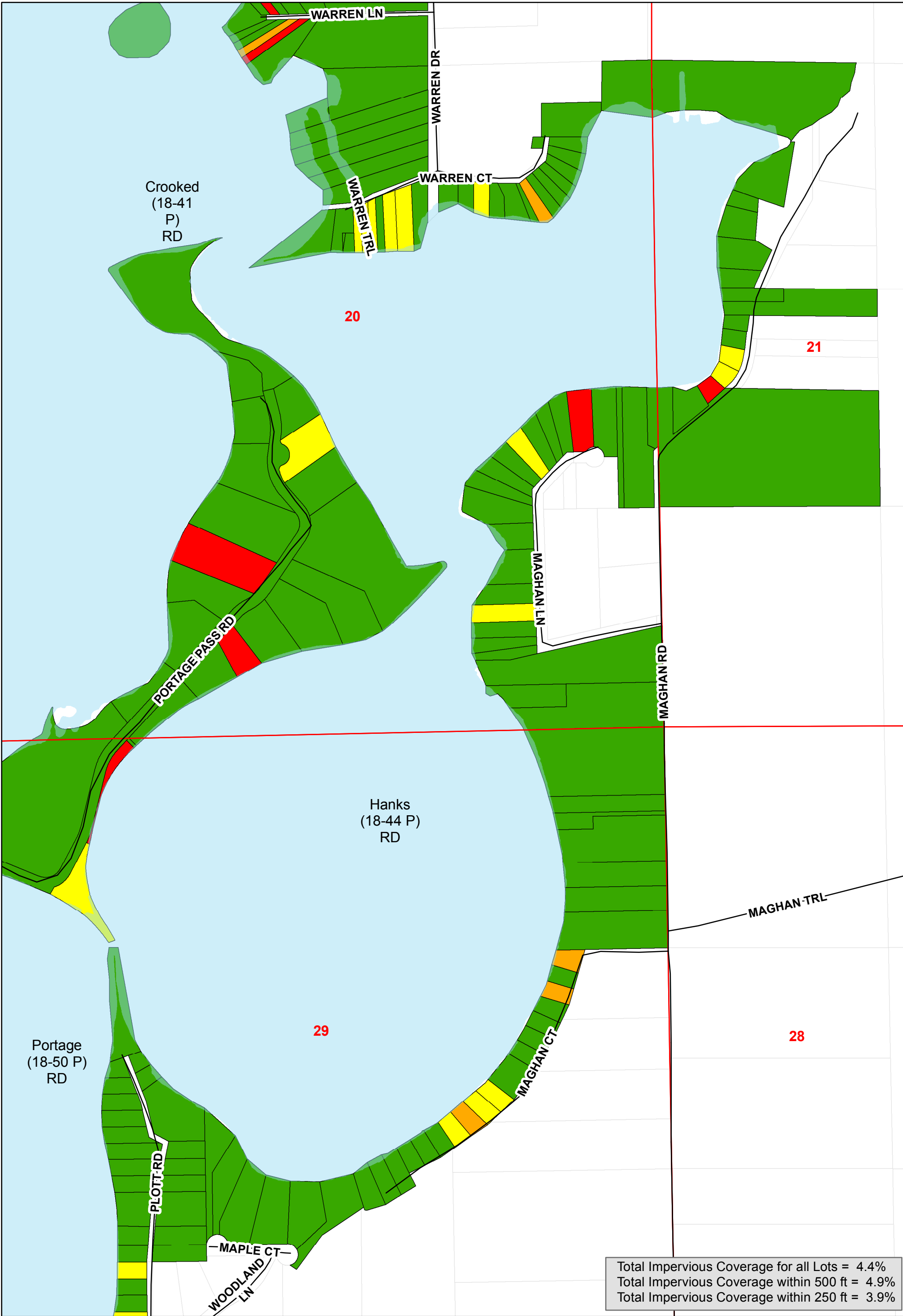
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Gilbert Lake

Impervious % within 250 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |



Total Impervious Coverage for all Lots = 4.4%
Total Impervious Coverage within 500 ft = 4.9%
Total Impervious Coverage within 250 ft = 3.9%

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CROW WING COUNTY

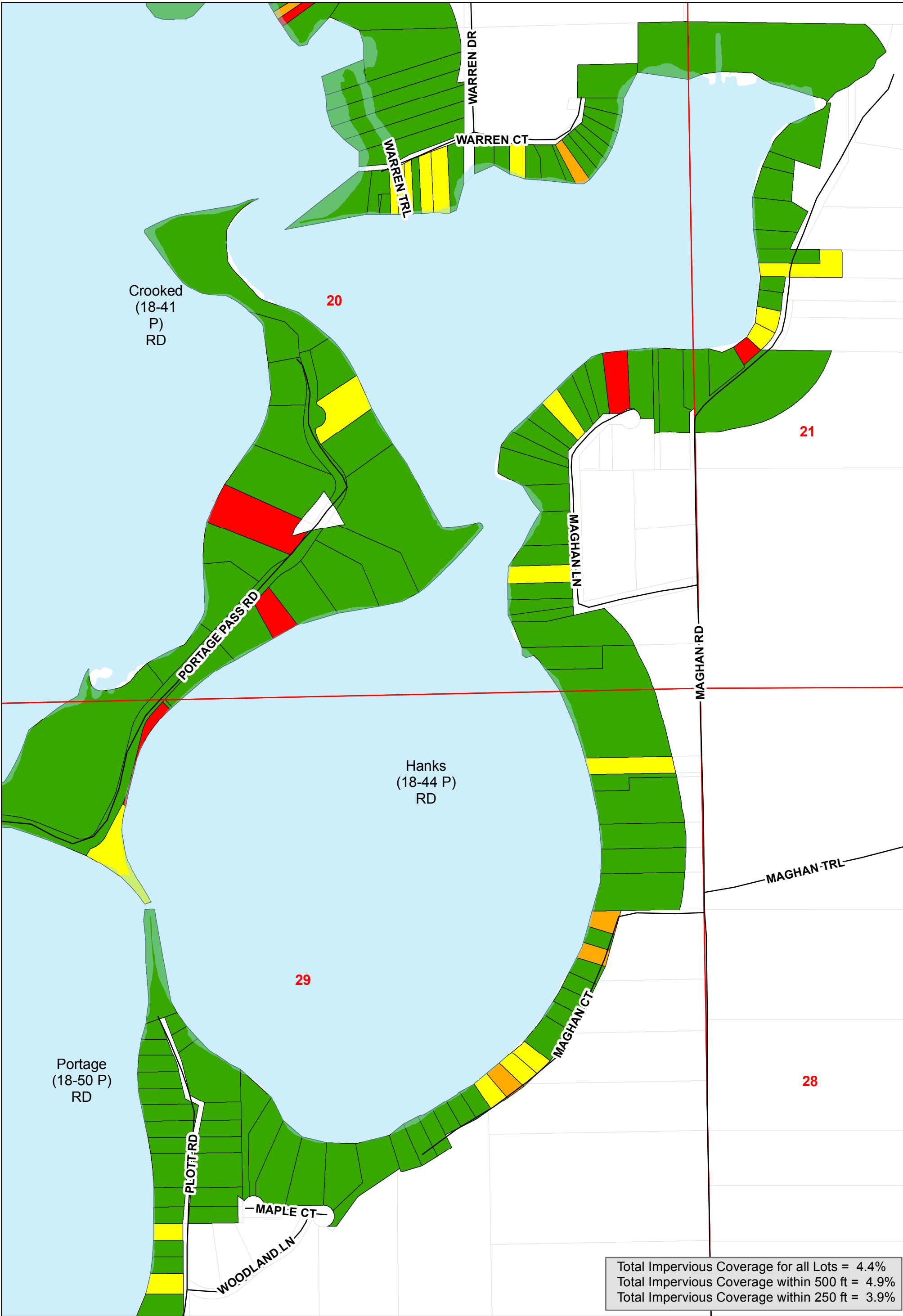


Hanks Lake

0 0.045 0.09 0.18 0.27 0.36 Miles

Impervious Surface Coverage by Parcel

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |



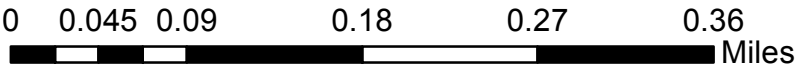
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CROW WING COUNTY



Hanks Lake



Impervious % within 500 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |



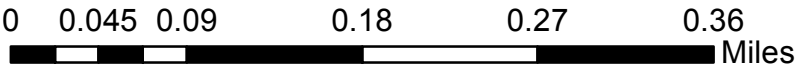
This data is provided on an "AS-IS" basis, without warranty of any type, expressed or implied, including but not limited to any warranty as to their performance, merchantability, or fitness for any particular purpose.



CROW WING COUNTY

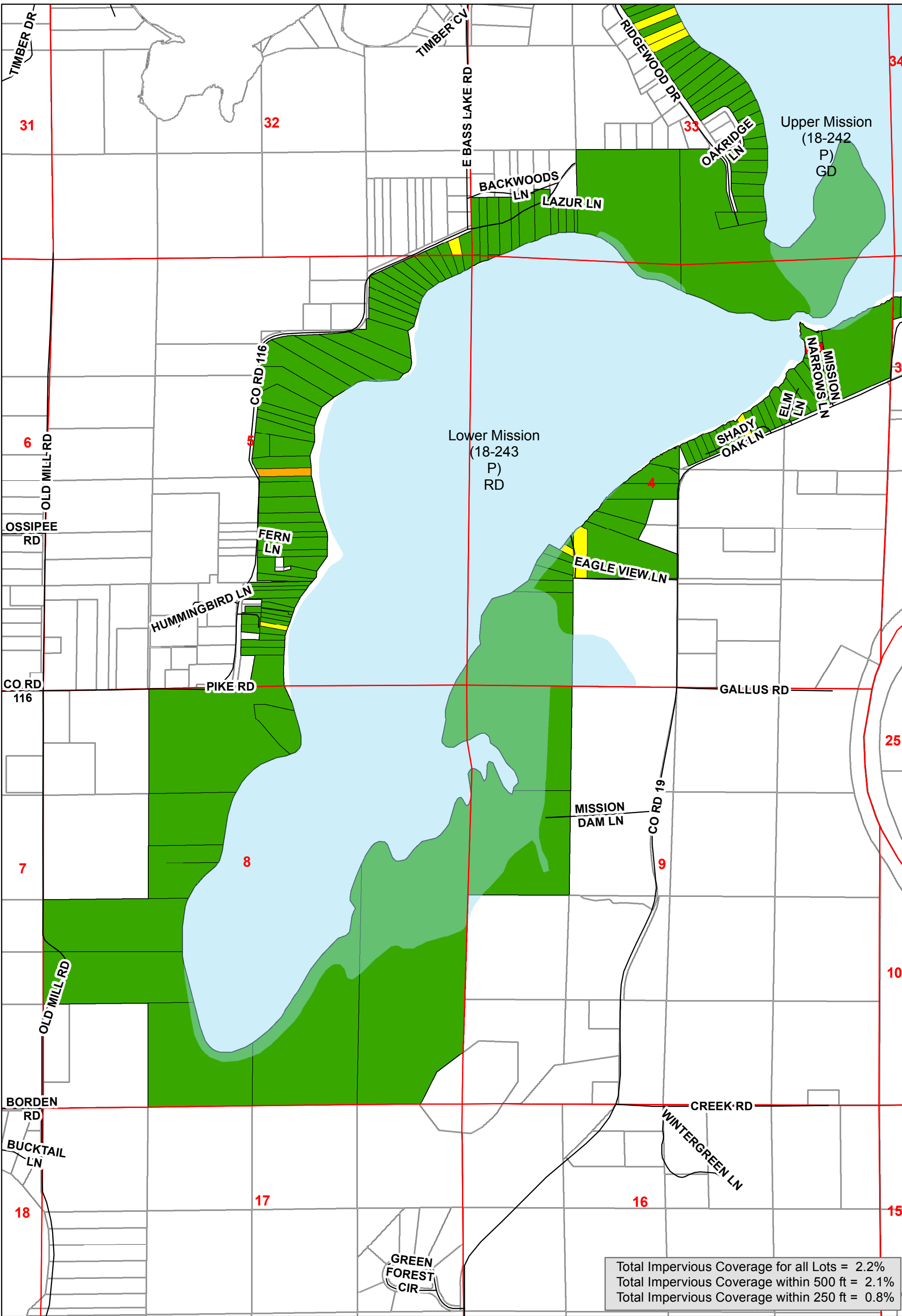


Hanks Lake



Impervious % within 250 ft of Shoreline

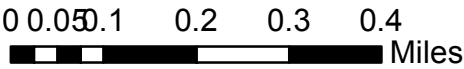
- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |



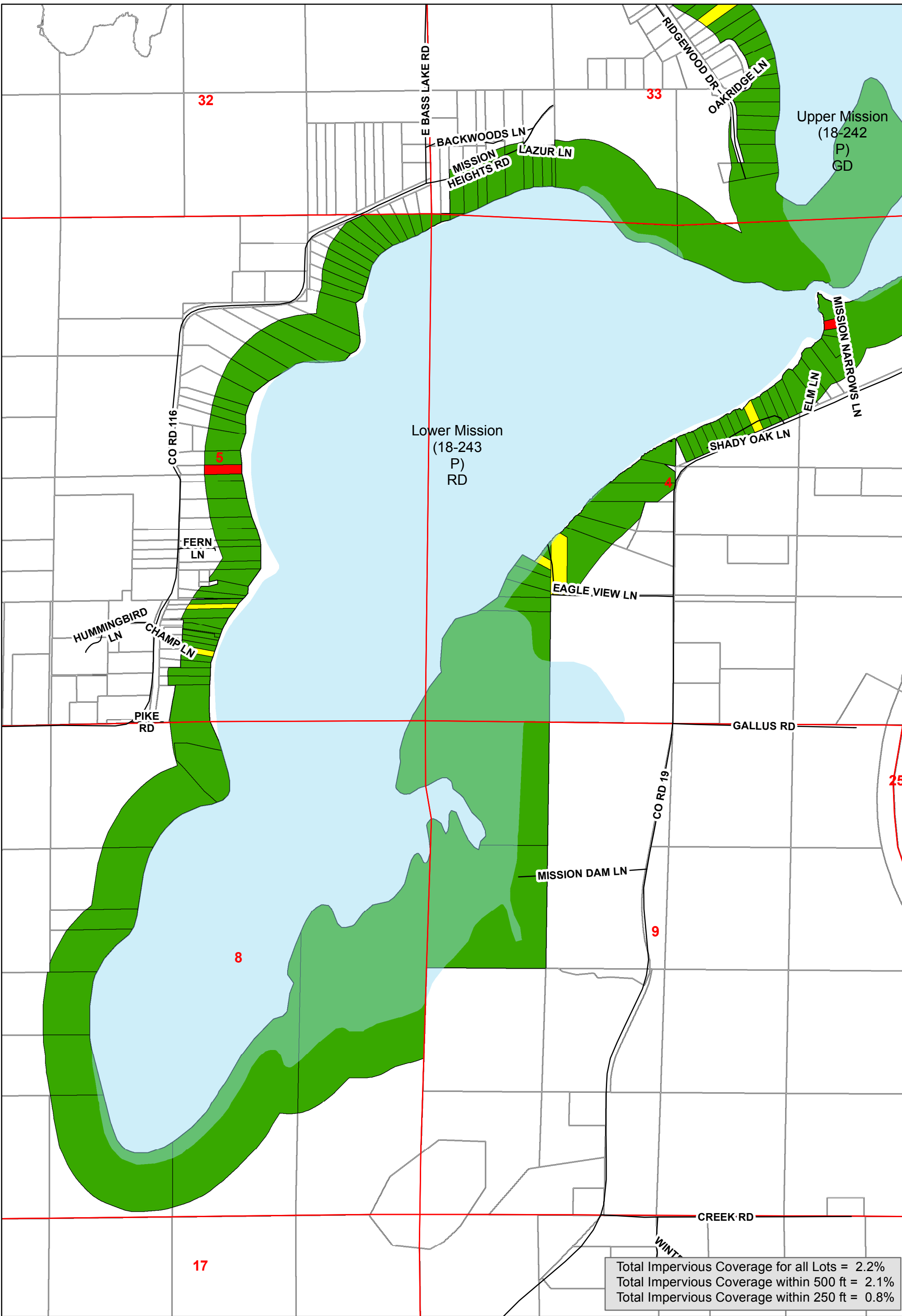
This data is provided on an "AS-IS" basis, without warranty of any type, expressed or implied, including but not limited to any warranty as to their performance, merchantability, or fitness for any particular purpose.



Lower Mission Lake



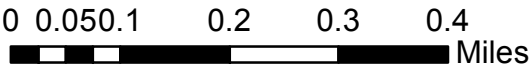
- Impervious Surface Coverage by Parcel
- Roads
 - Section Lines
 - City
 - Parcels
 - Lakes



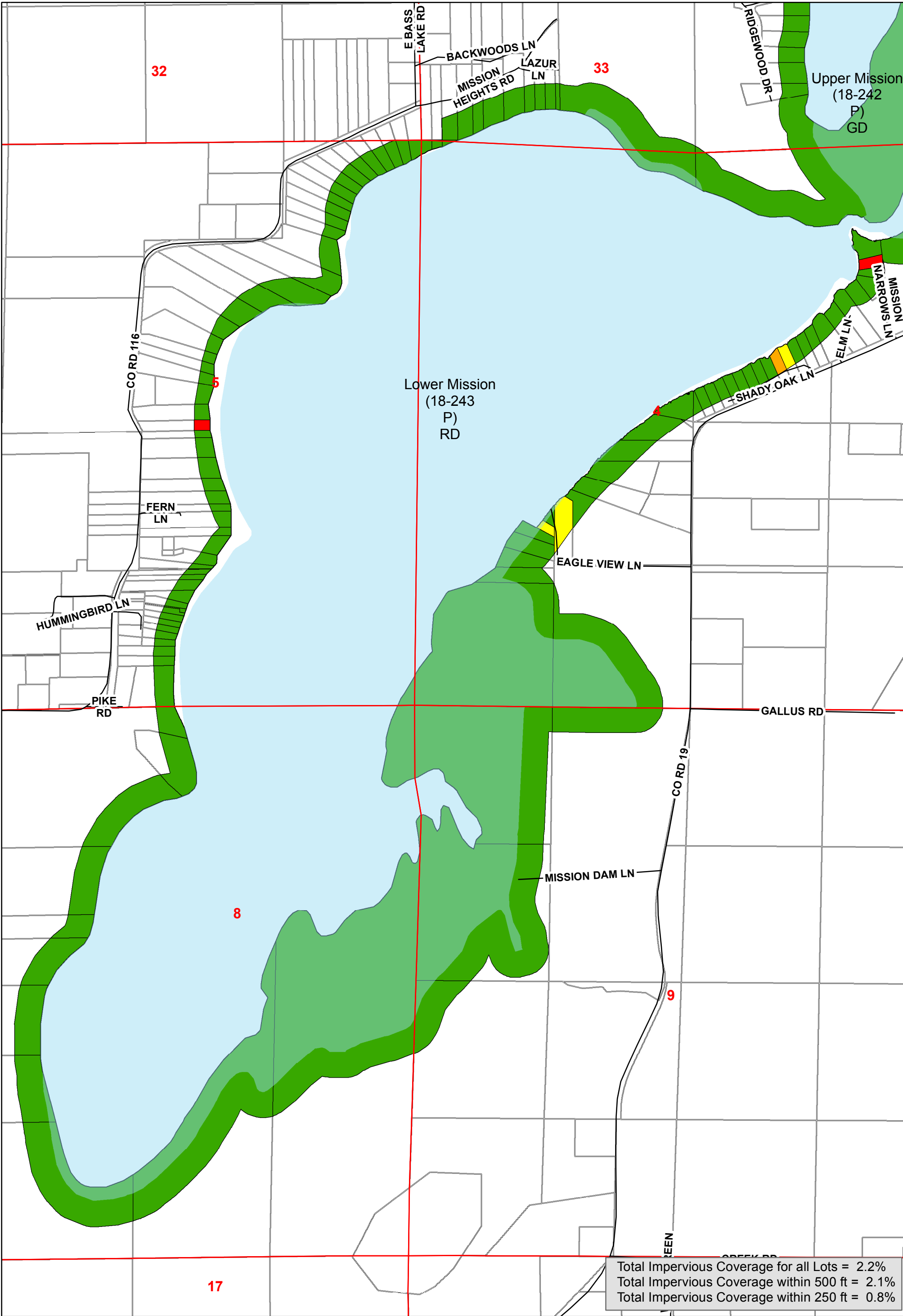
This data is provided on an "AS-IS" basis, without warranty of any type, expressed or implied, including but not limited to any warranty as to their performance, merchantability, or fitness for any particular purpose.



Lower Mission Lake



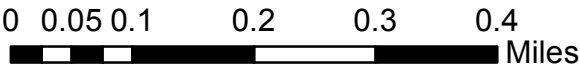
CROW WING COUNTY



This data is provided on an "AS-IS" basis, without warranty of any type, expressed or implied, including but not limited to any warranty as to their performance, merchantability, or fitness for any particular purpose.



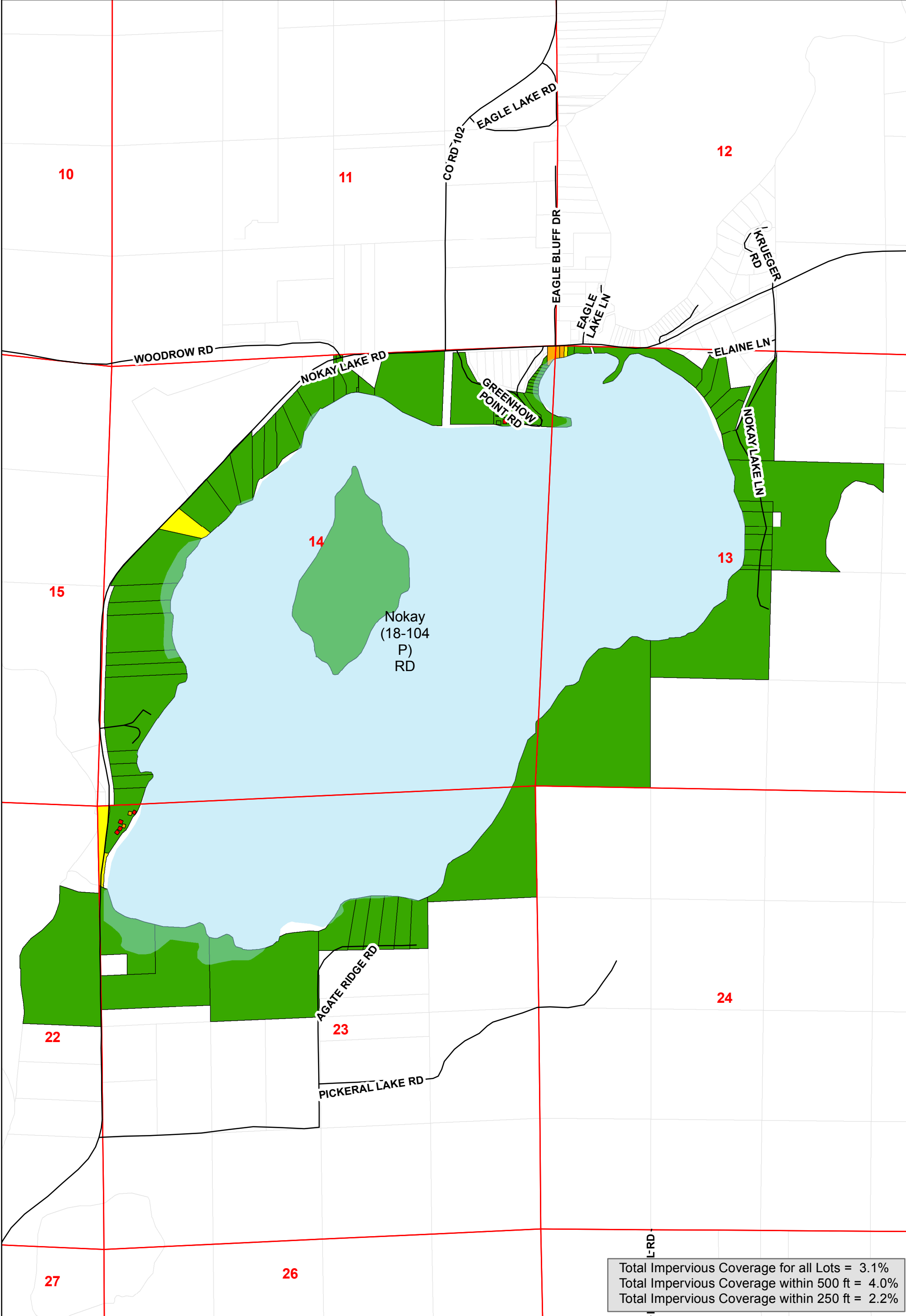
Lower Mission Lake



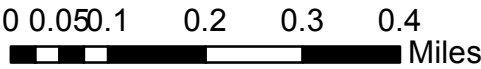
Impervious % within 250 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |





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Nokay Lake

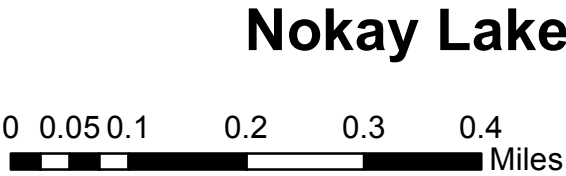
Impervious Surface Coverage by Parcel

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |

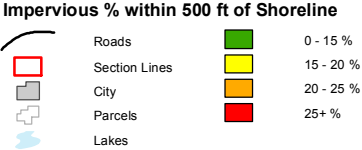




This data is provided on an "AS-IS" basis, without warranty of any type, expressed or implied, including but not limited to any warranty as to their performance, merchantability, or fitness for any particular purpose.



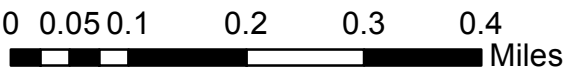
CROW WING COUNTY





Total Impervious Coverage for all Lots = 3.1%
Total Impervious Coverage within 500 ft = 4.0%
Total Impervious Coverage within 250 ft = 2.2%

Nokay Lake

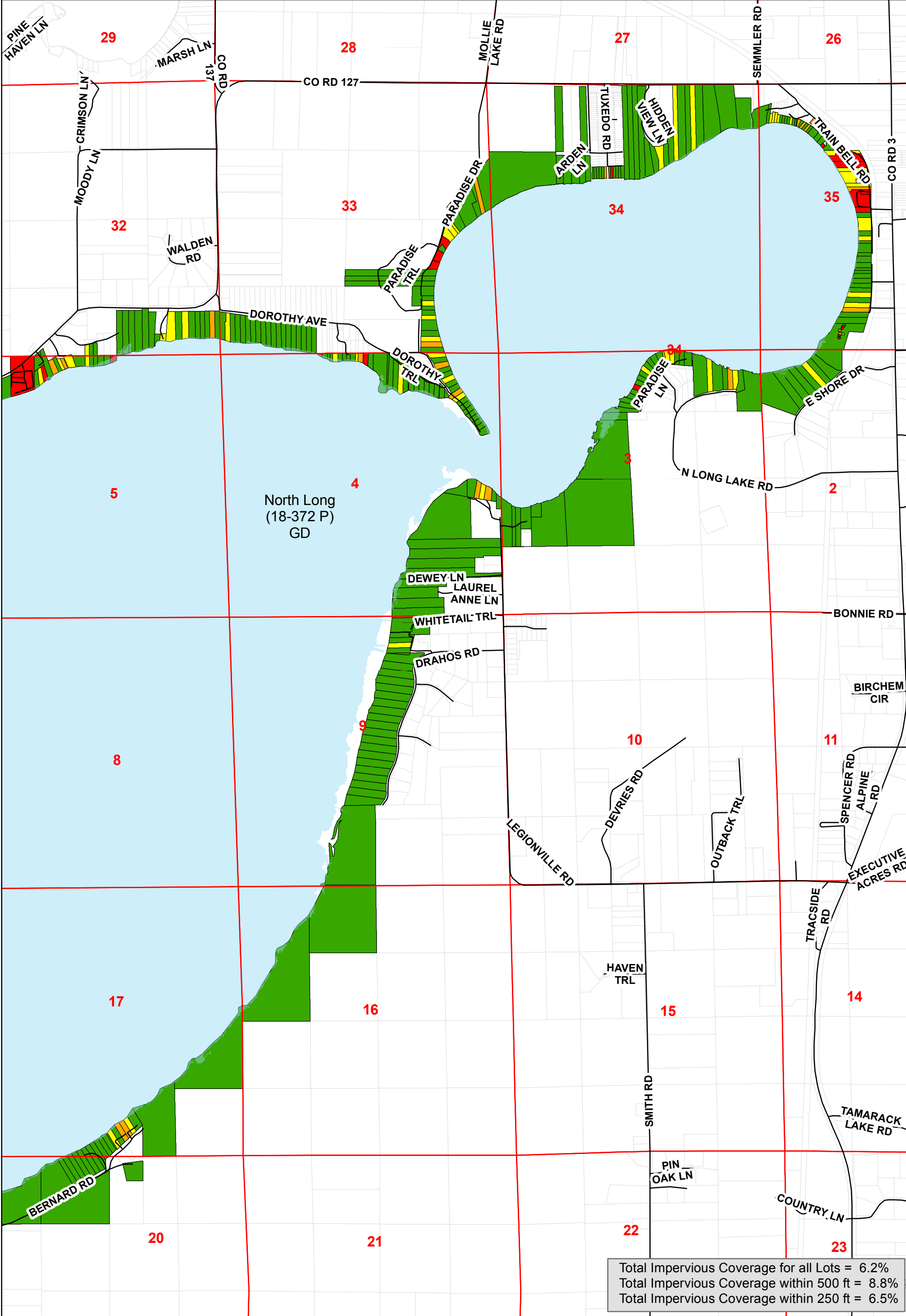


- Impervious % within 250 ft of Shoreline
- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |

This data is provided on an "AS-IS" basis, without warranty of any type, expressed or implied, including but not limited to any warranty as to their performance, merchantability, or fitness for any particular purpose.



CROW WING COUNTY

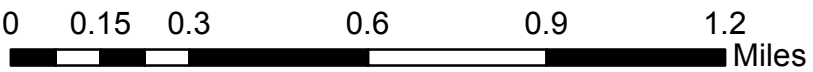


Total Impervious Coverage for all Lots = 6.2%
Total Impervious Coverage within 500 ft = 8.8%
Total Impervious Coverage within 250 ft = 6.5%

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North Long Lake (East)



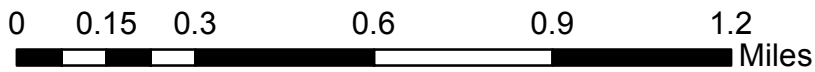
- Impervious Surface Coverage by Parcel**
- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |

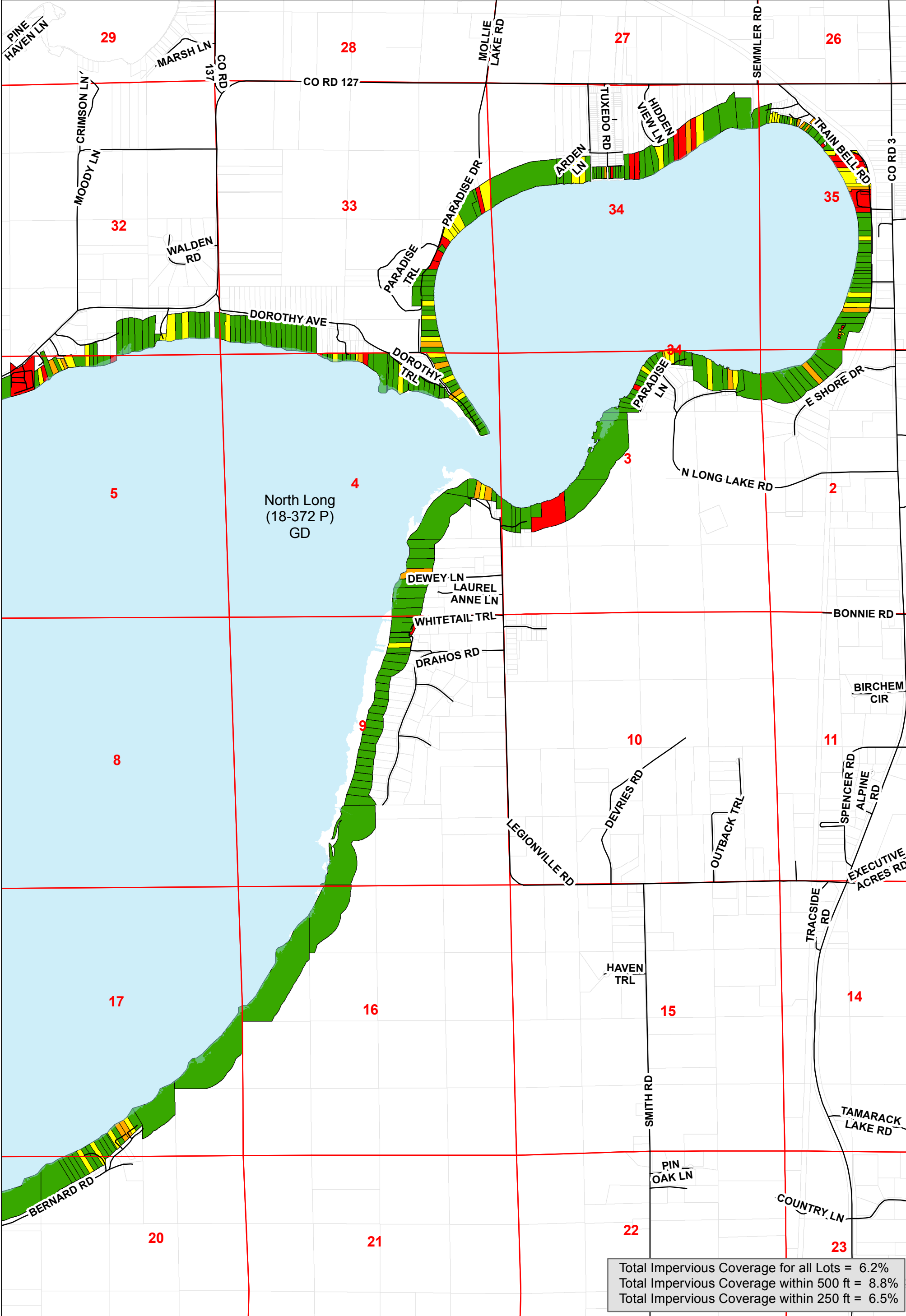


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North Long Lake (West)

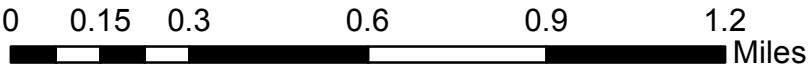




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North Long Lake (East)



Impervious % within 500 ft of Shoreline

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |

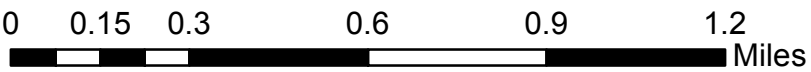




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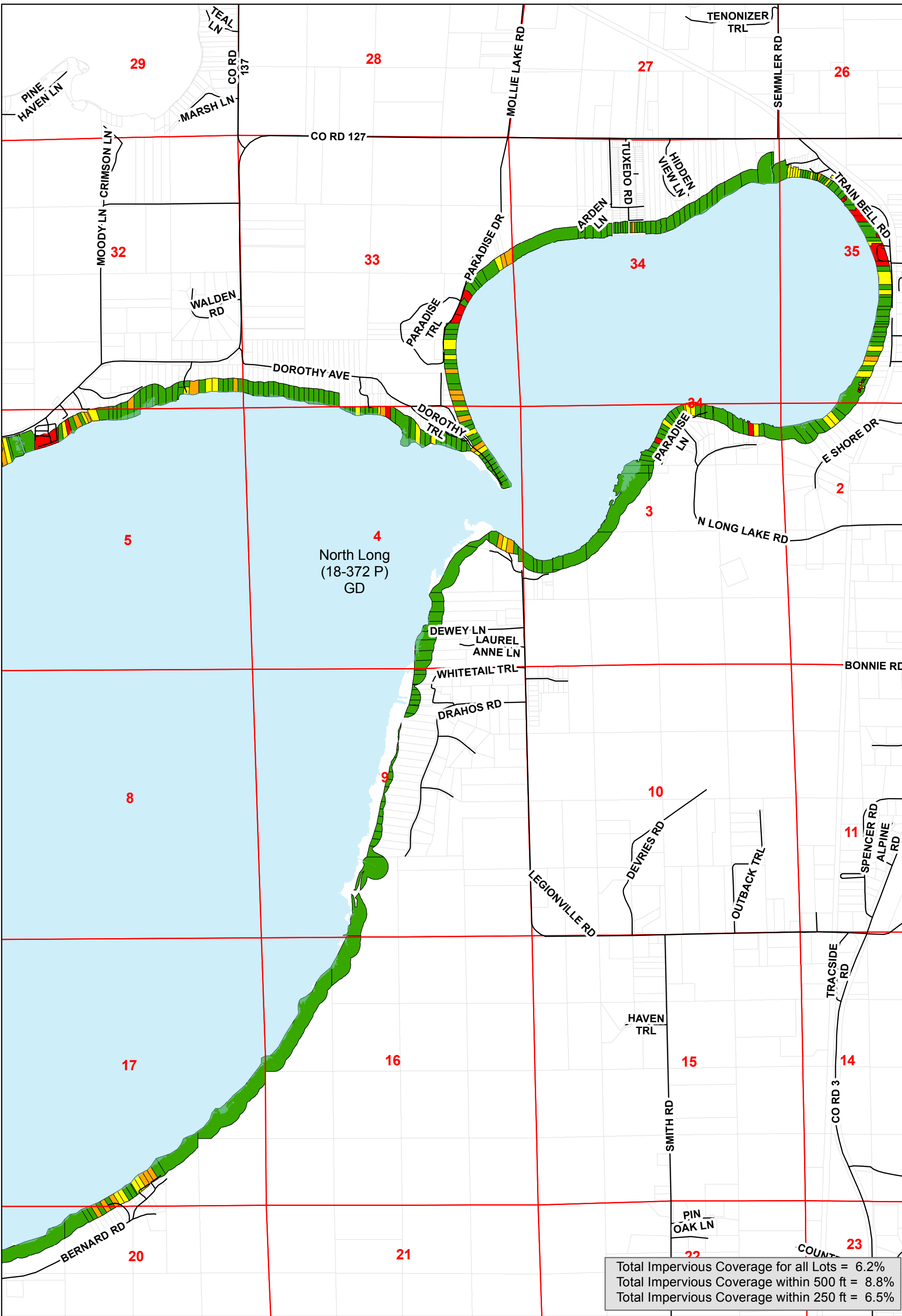
North Long Lake (West)



Impervious % within 500 ft of Shoreline

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |



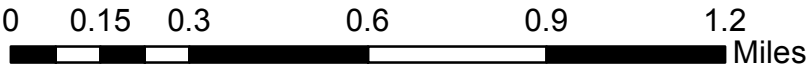


Total Impervious Coverage for all Lots = 6.2%
Total Impervious Coverage within 500 ft = 8.8%
Total Impervious Coverage within 250 ft = 6.5%

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North Long Lake (East)



Impervious % within 250 ft of Shoreline

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |



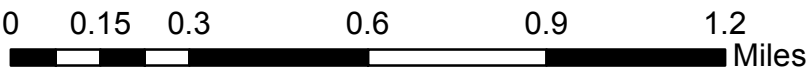
CROW WING COUNTY



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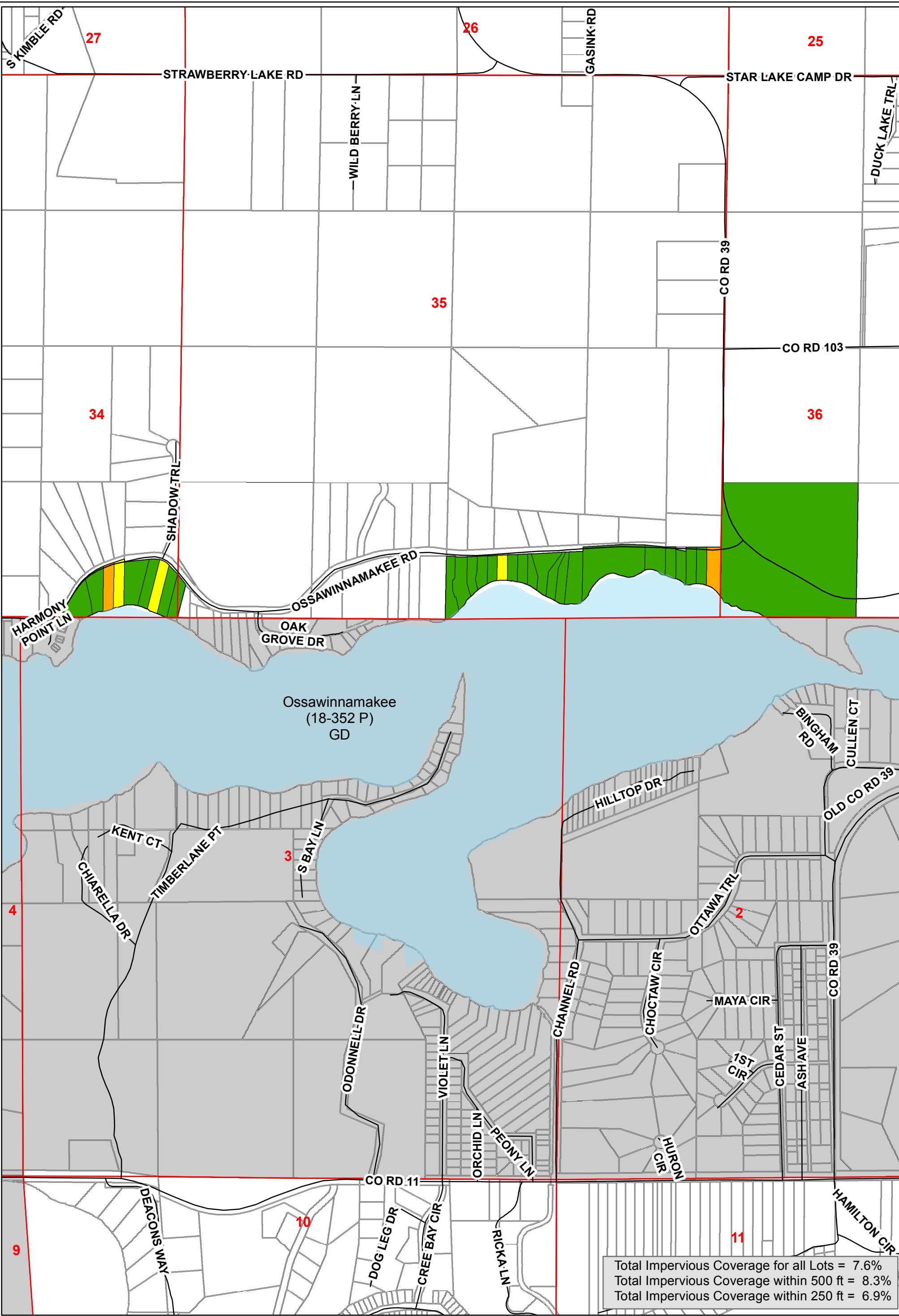
North Long Lake (West)



Impervious % within 250 ft of Shoreline

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |





Total Impervious Coverage for all Lots = 7.6%
Total Impervious Coverage within 500 ft = 8.3%
Total Impervious Coverage within 250 ft = 6.9%

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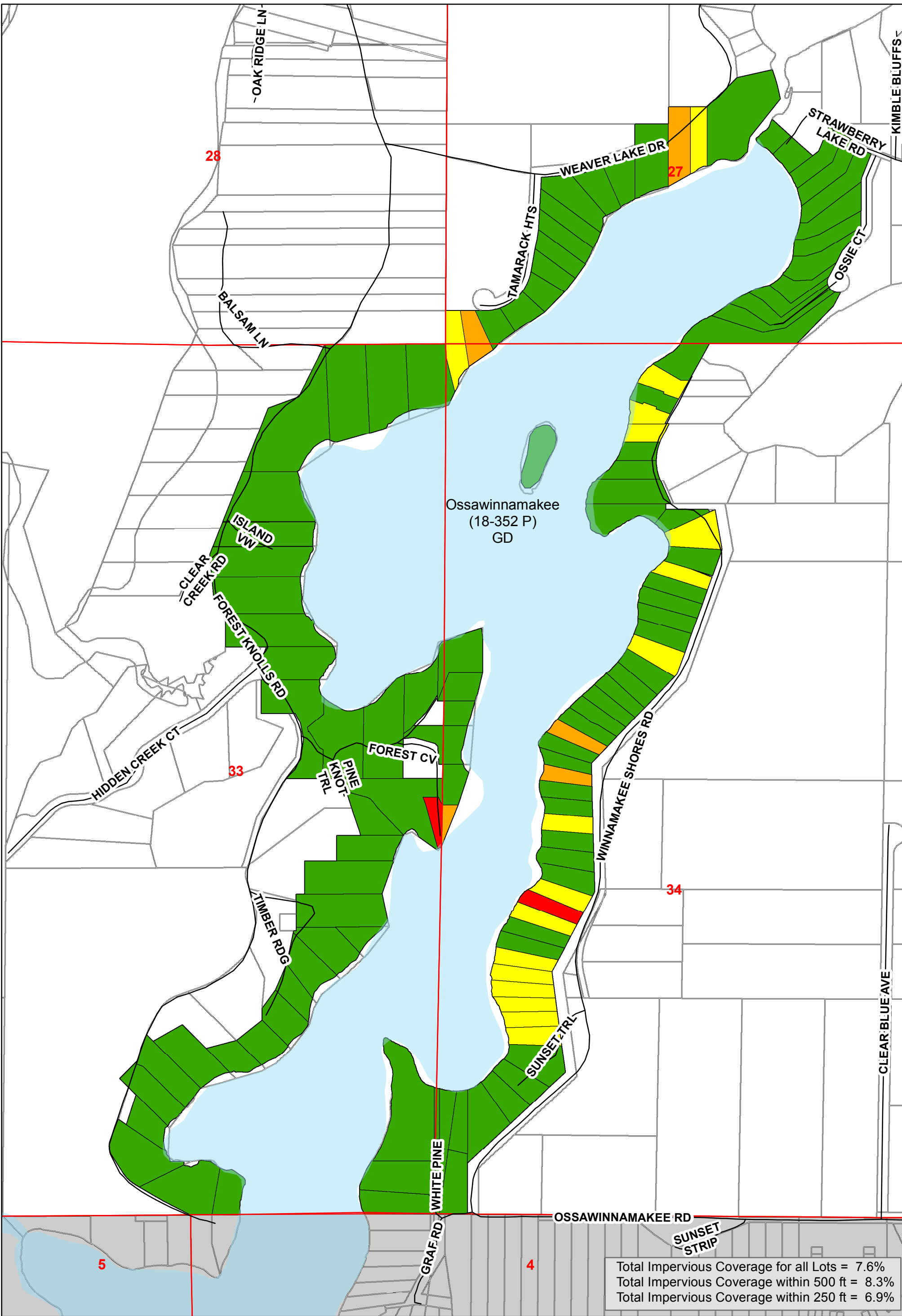
Ossawinnamakee Lake (East)

0 0.05 0.1 0.2 0.3 0.4 Miles

Impervious Surface Coverage by Parcel

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |

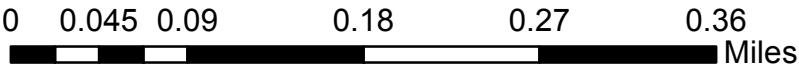




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Ossawinnamakee Lake (West)

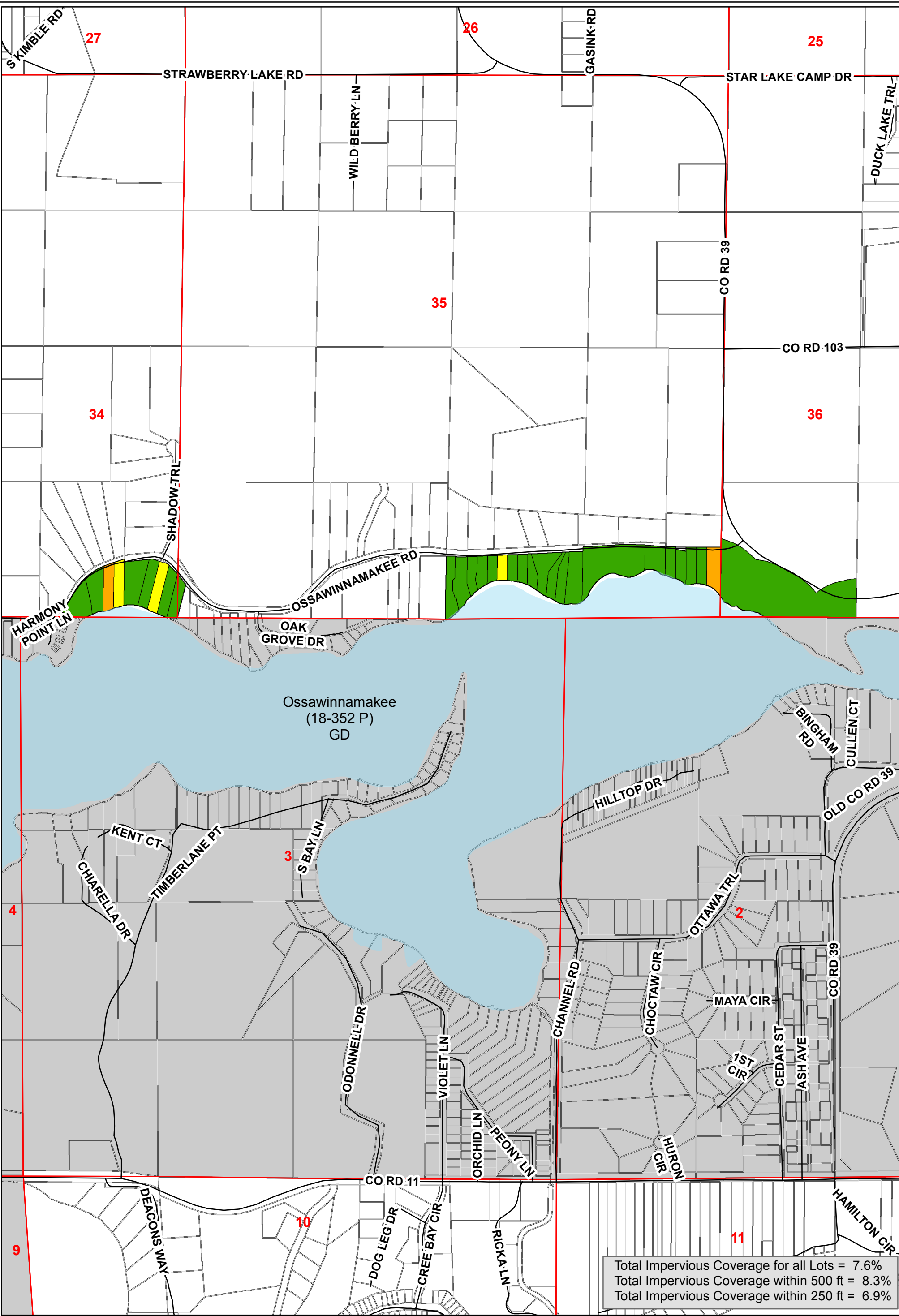


Impervious Surface Coverage by Parcel

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |



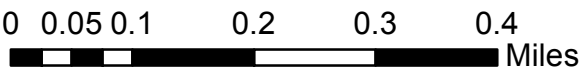
CROW WING COUNTY

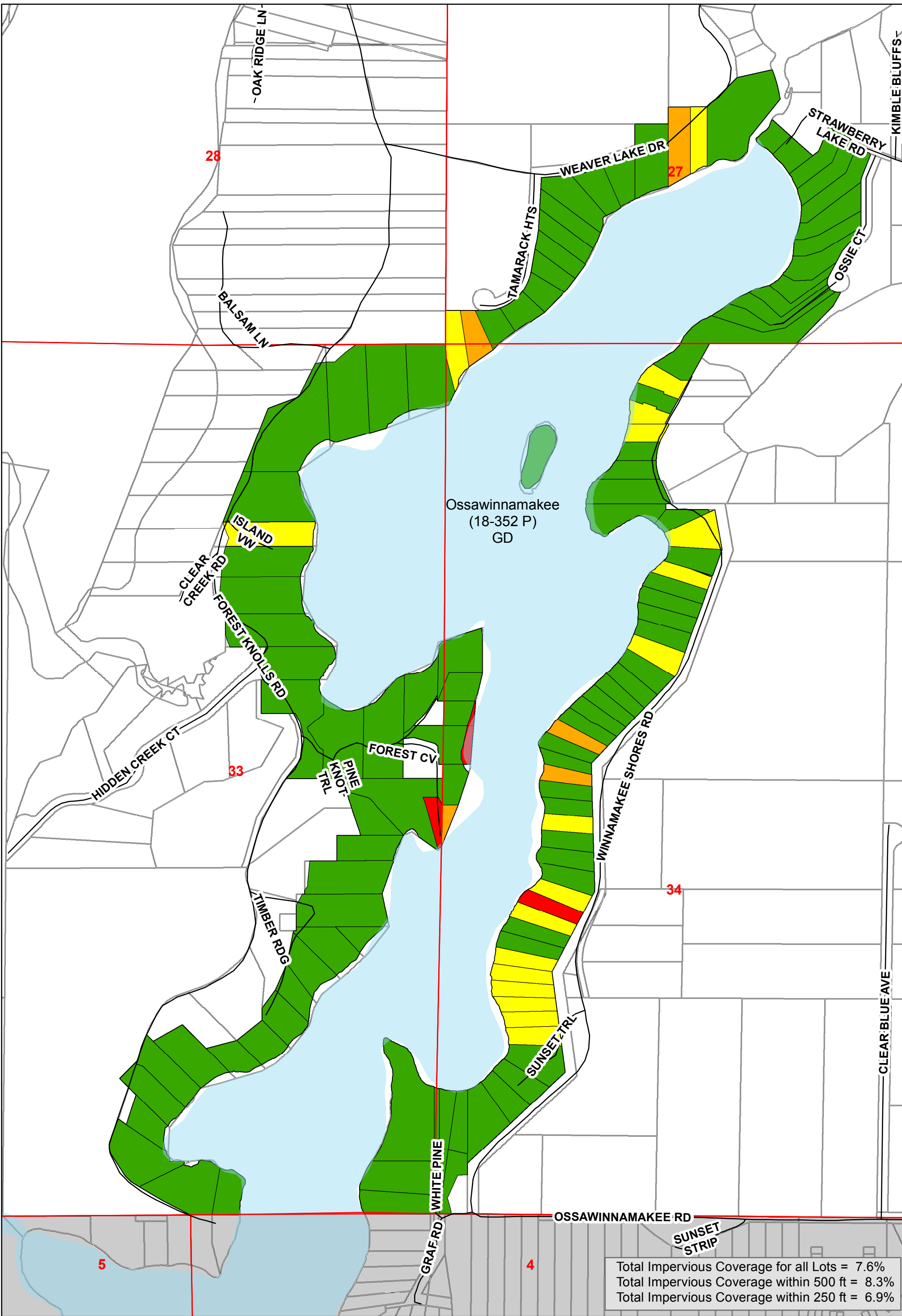


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Ossawinnamakee Lake (East)





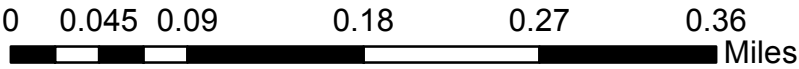
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CROW WING COUNTY

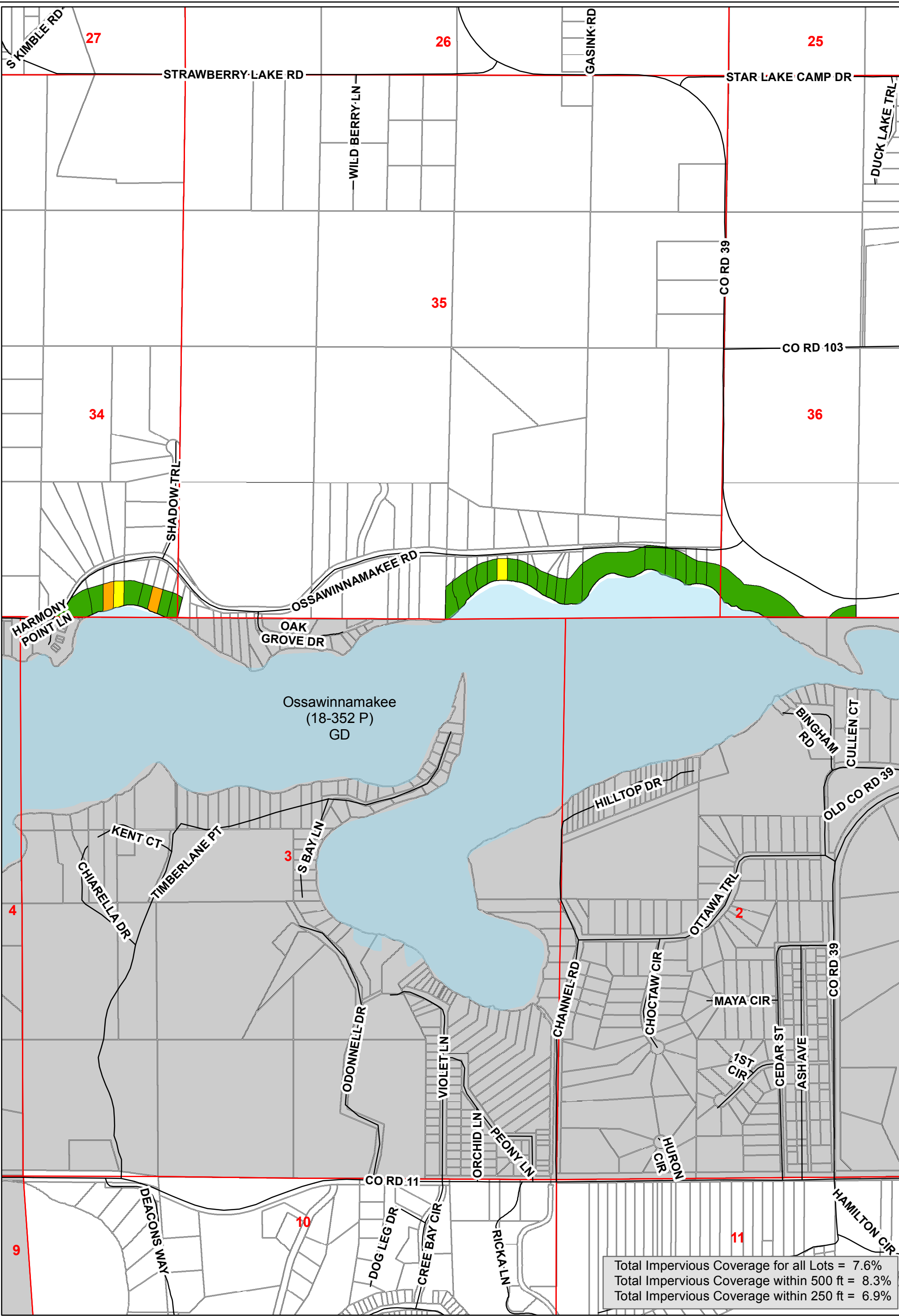


Ossawinnamakee Lake (West)



Impervious % within 500 ft of Shoreline

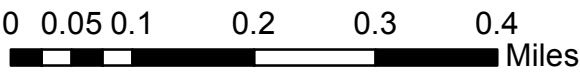
- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |

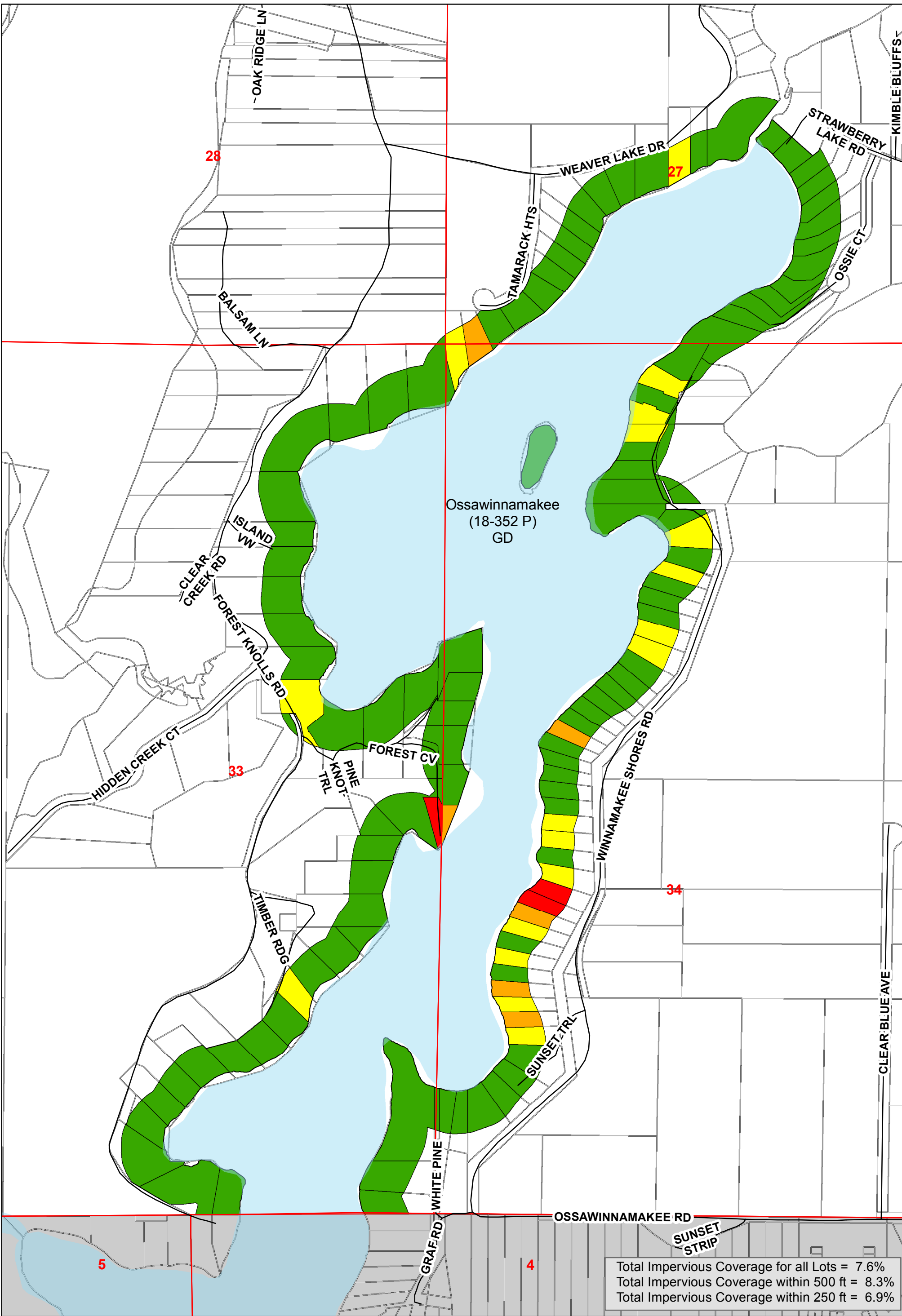


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Ossawinnamakee Lake (East)

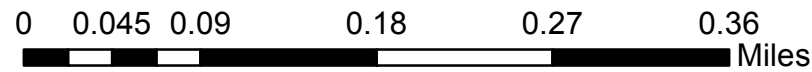




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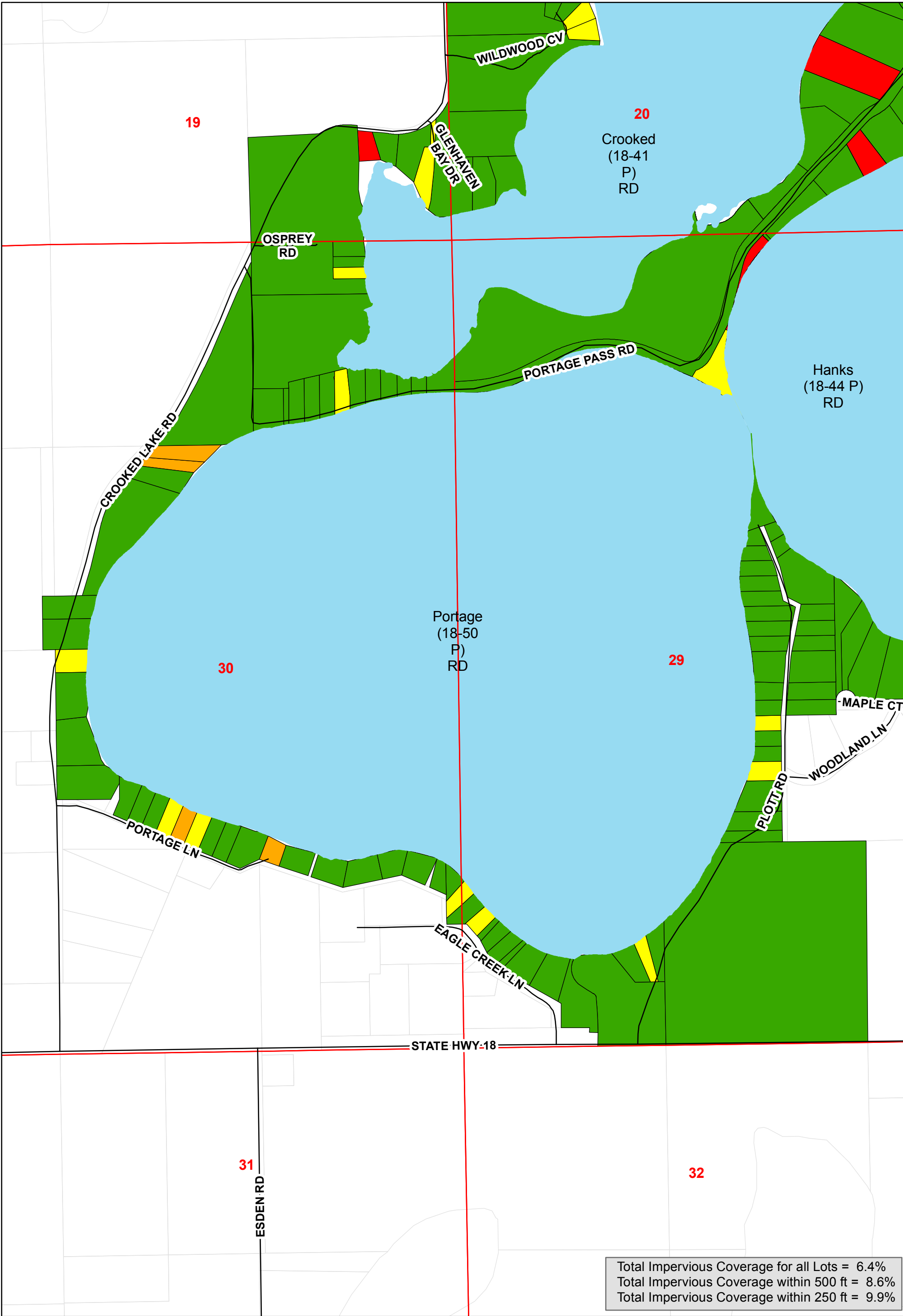
Ossawinnamakee Lake (West)



Impervious % within 250 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |





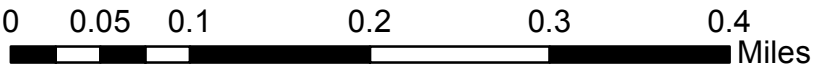
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CROW WING COUNTY



Portage Lake



Impervious Surface Coverage by Parcel

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |



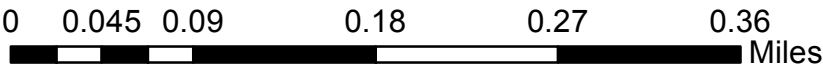
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CROW WING COUNTY



Portage Lake



Impervious % within 500 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |



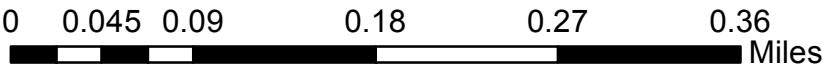
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CROW WING COUNTY

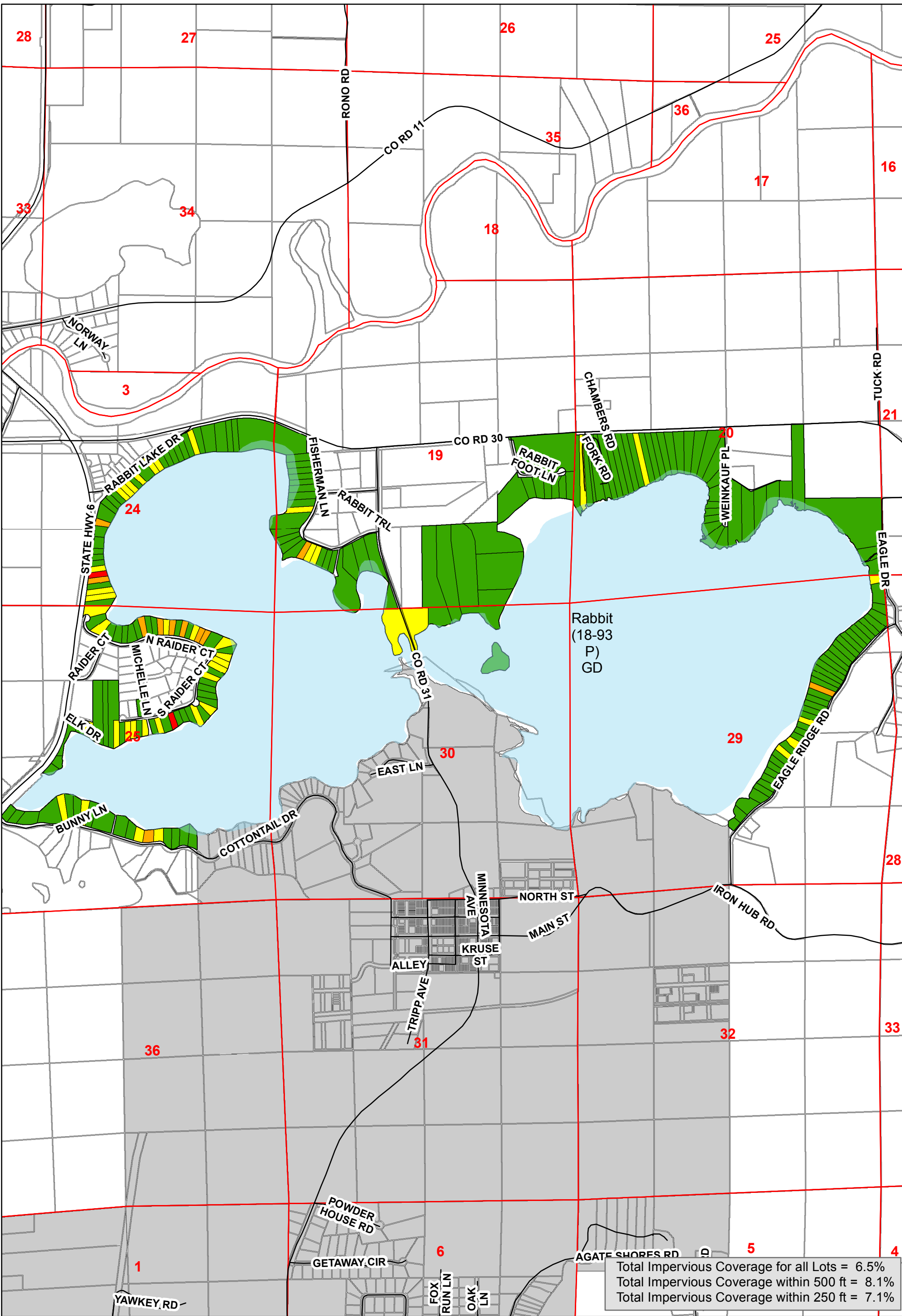


Portage Lake

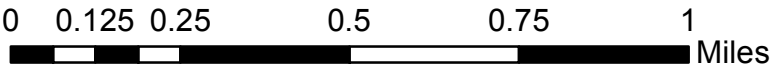


Impervious % within 250 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |



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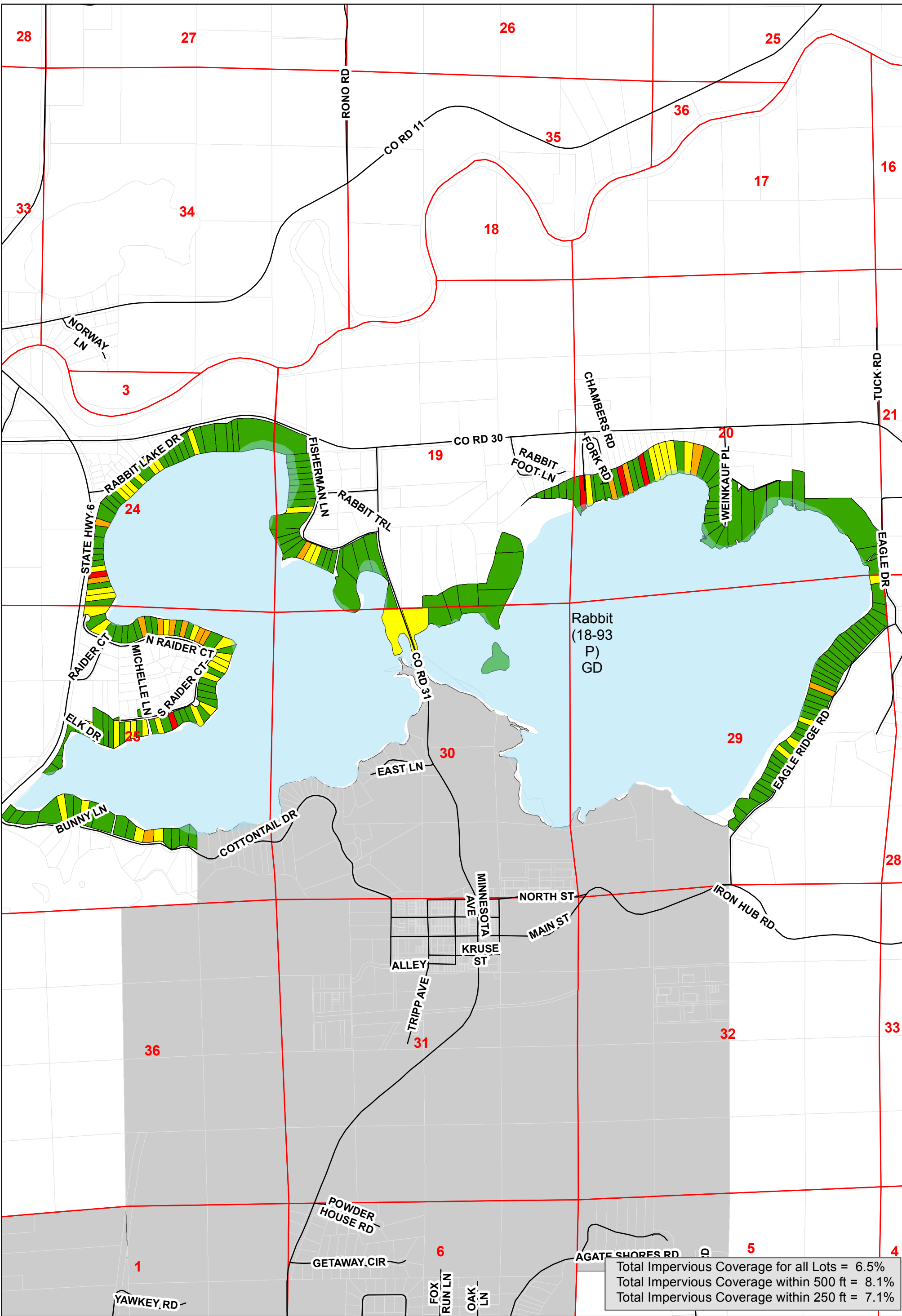


Rabbit Lake

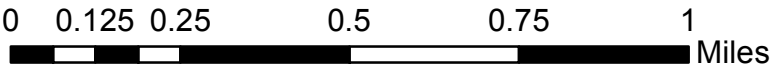
Impervious Surface Coverage by Parcel

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |





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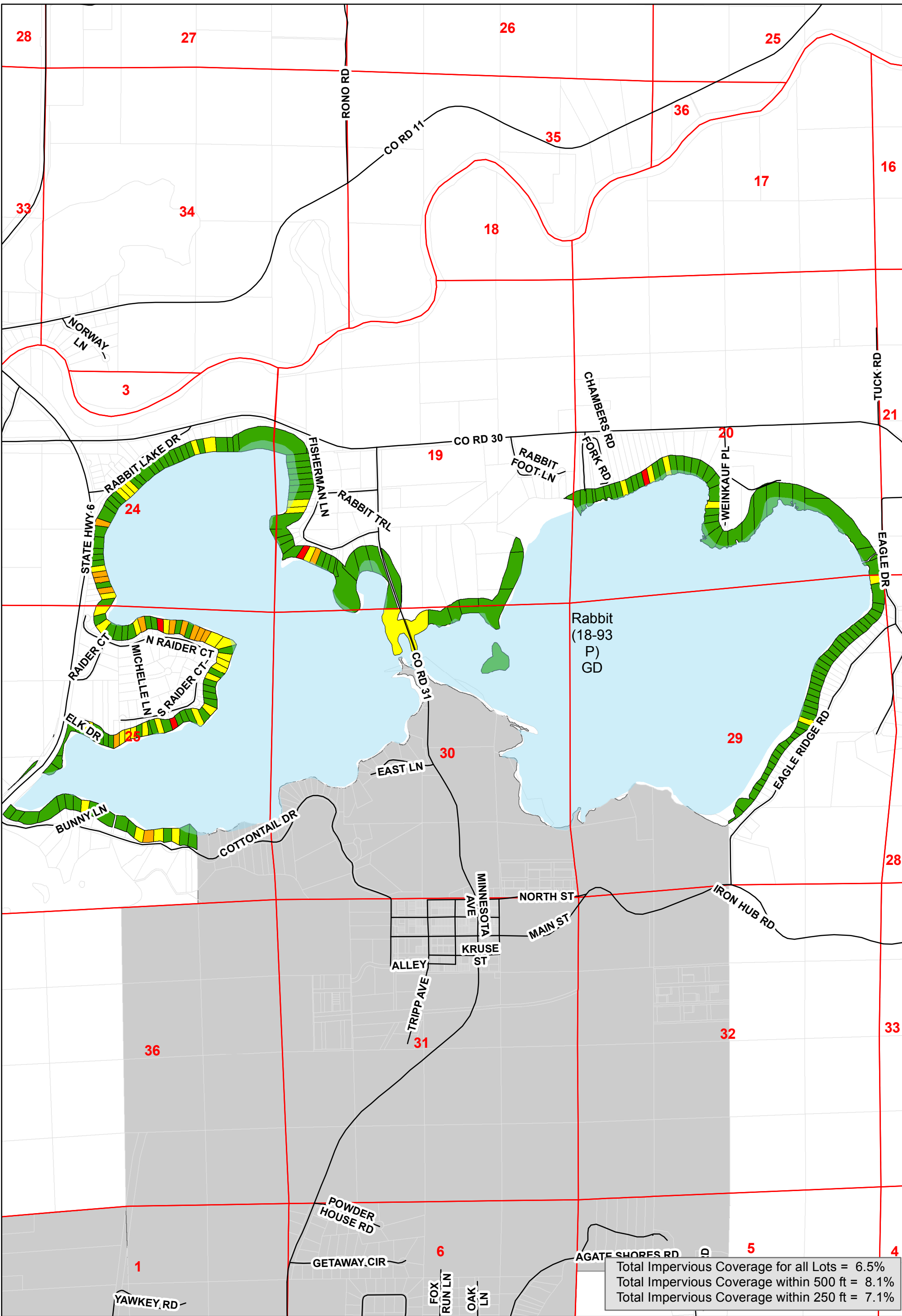
Rabbit Lake

Impervious % within 500 ft of Shoreline

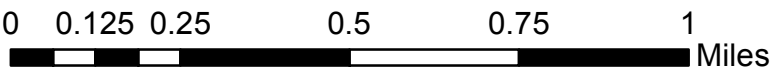
- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |



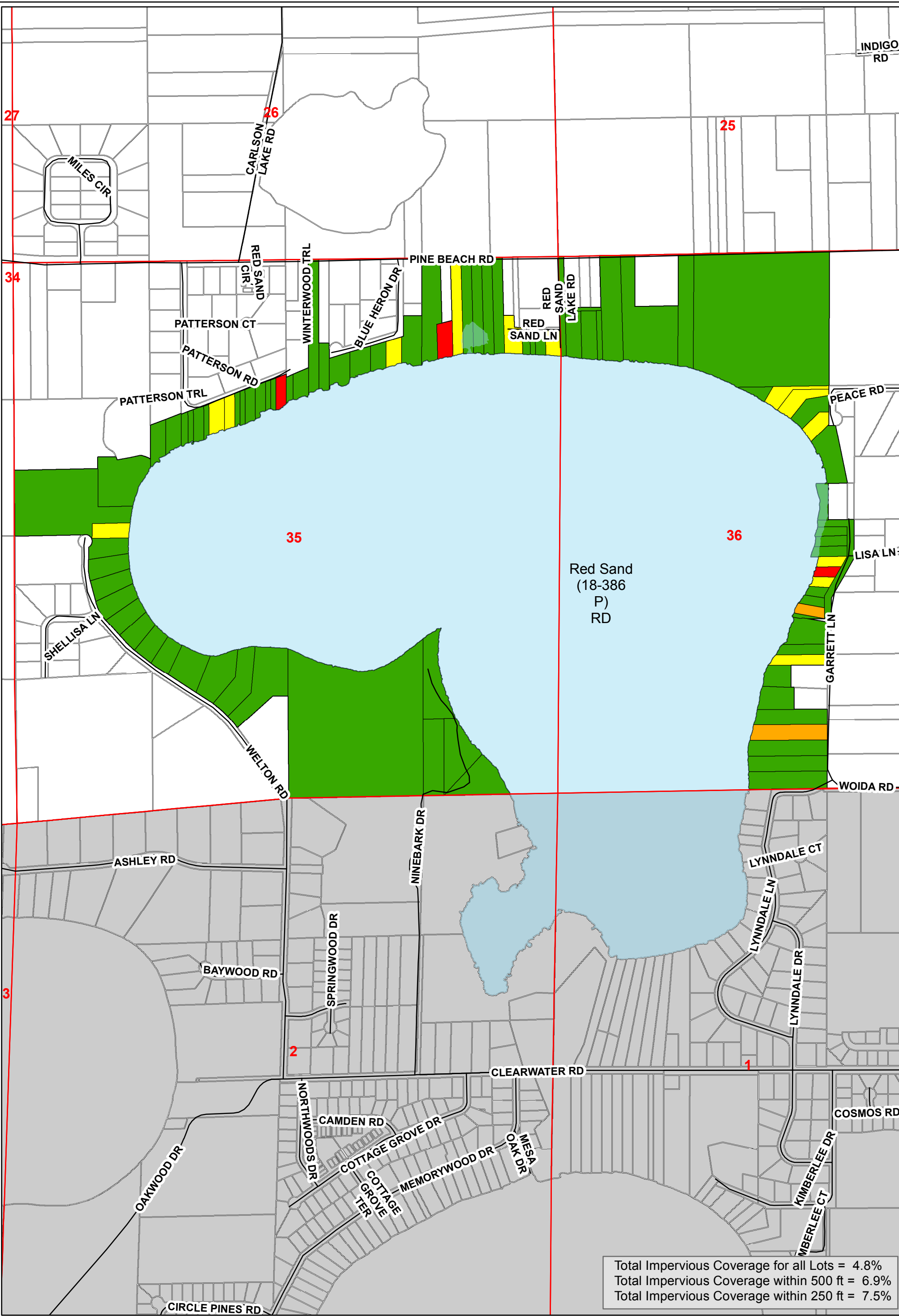
CROW WING COUNTY



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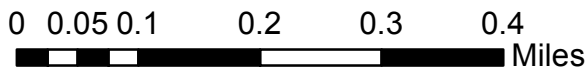
CROW WING COUNTY



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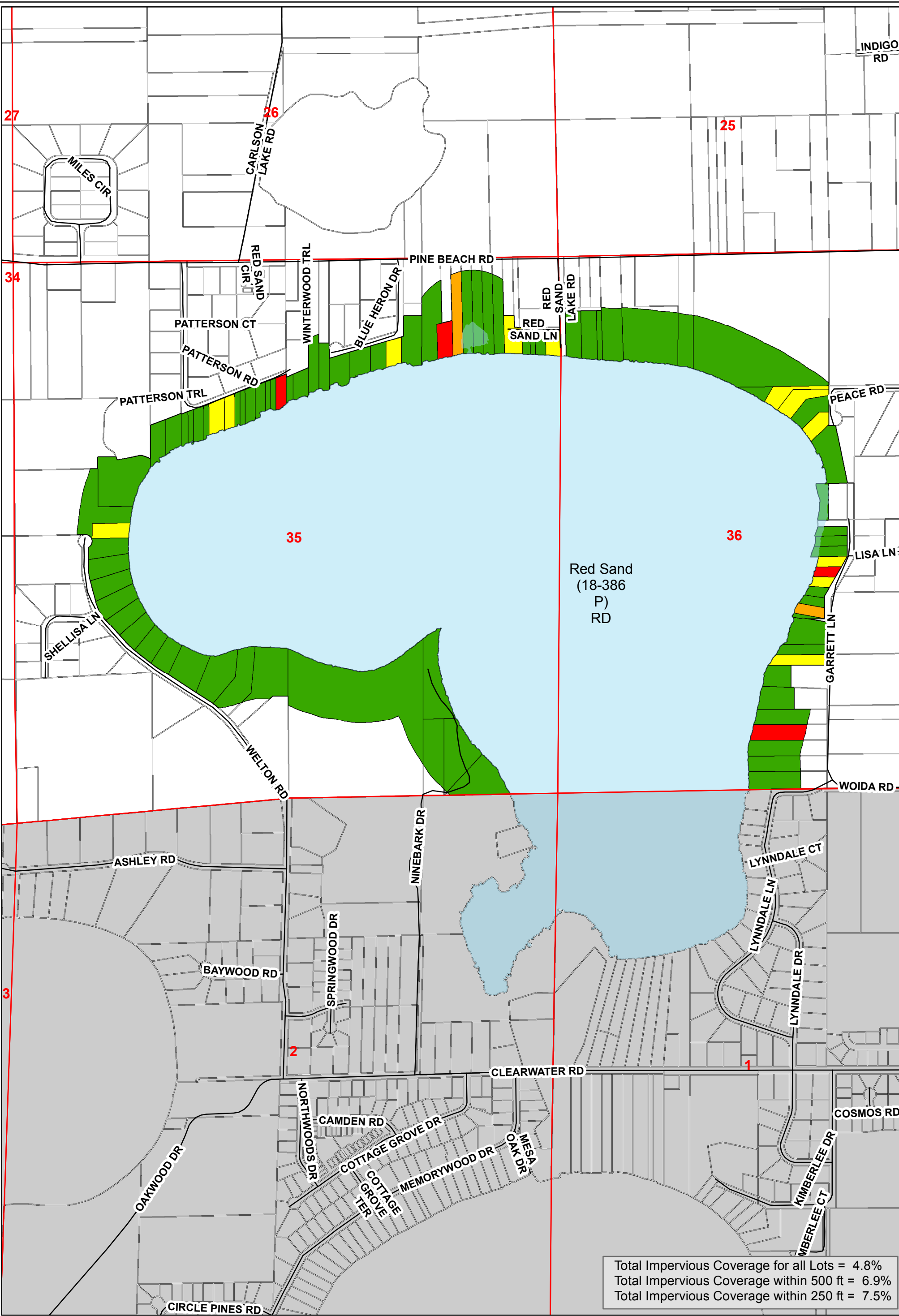
Red Sand Lake



Impervious Surface Coverage by Parcel

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |





Total Impervious Coverage for all Lots = 4.8%
Total Impervious Coverage within 500 ft = 6.9%
Total Impervious Coverage within 250 ft = 7.5%

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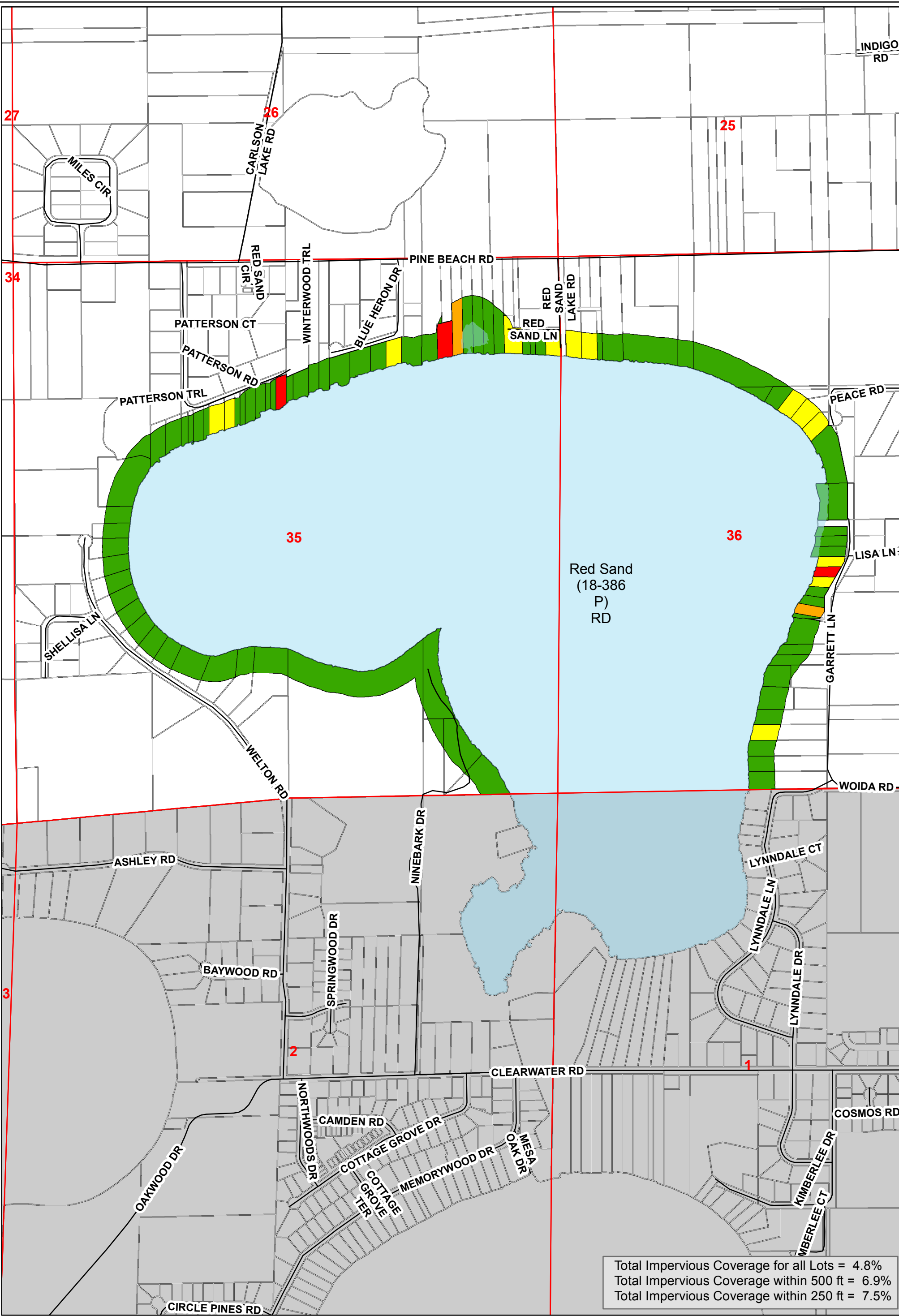
Red Sand Lake

0 0.05 0.1 0.2 0.3 0.4 Miles

Impervious % within 500 ft of Shoreline

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |





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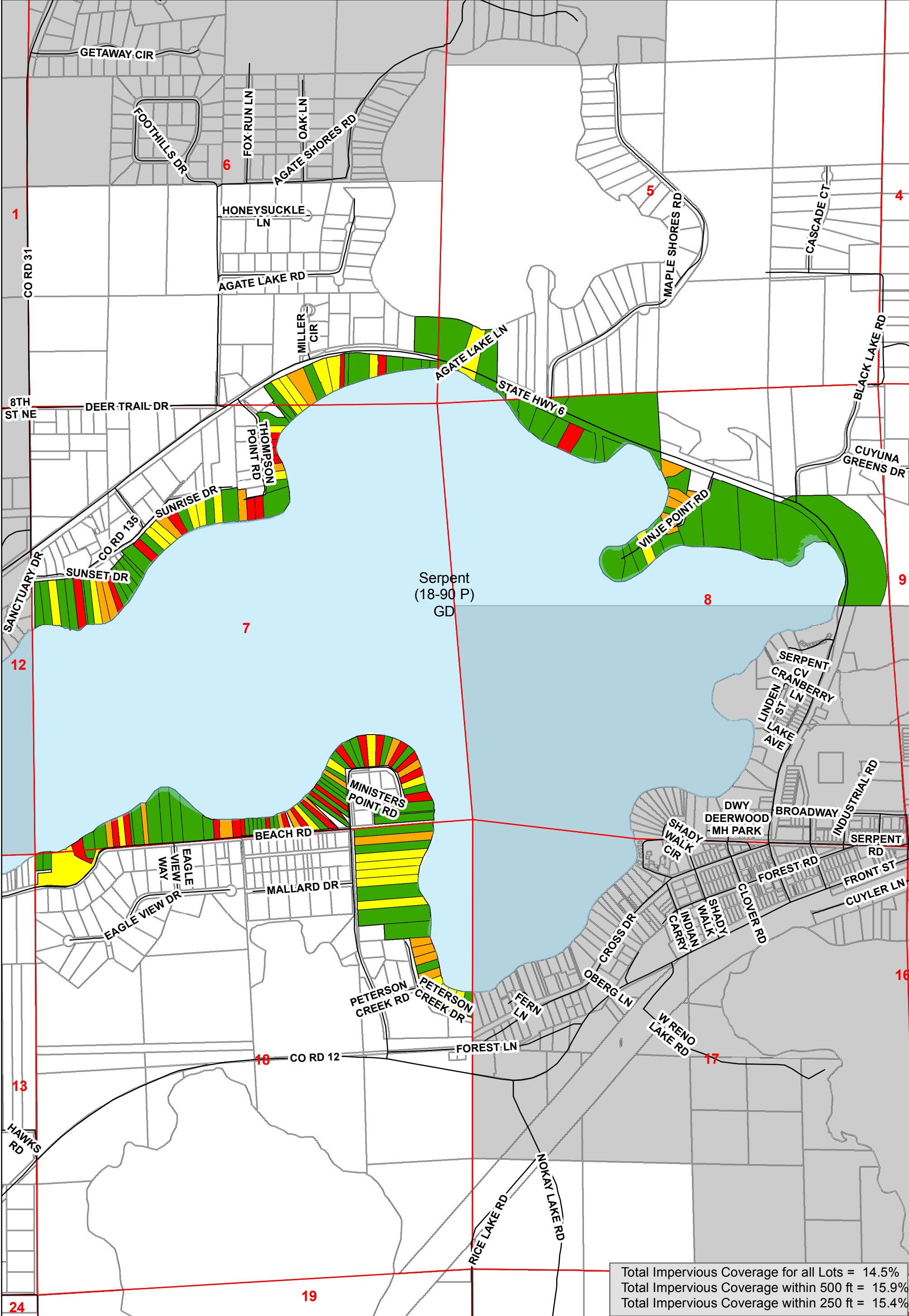
Red Sand Lake

0 0.05 0.1 0.2 0.3 0.4 Miles

Impervious % within 250 ft of Shoreline

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |

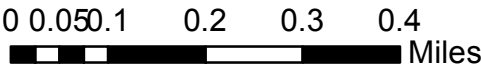




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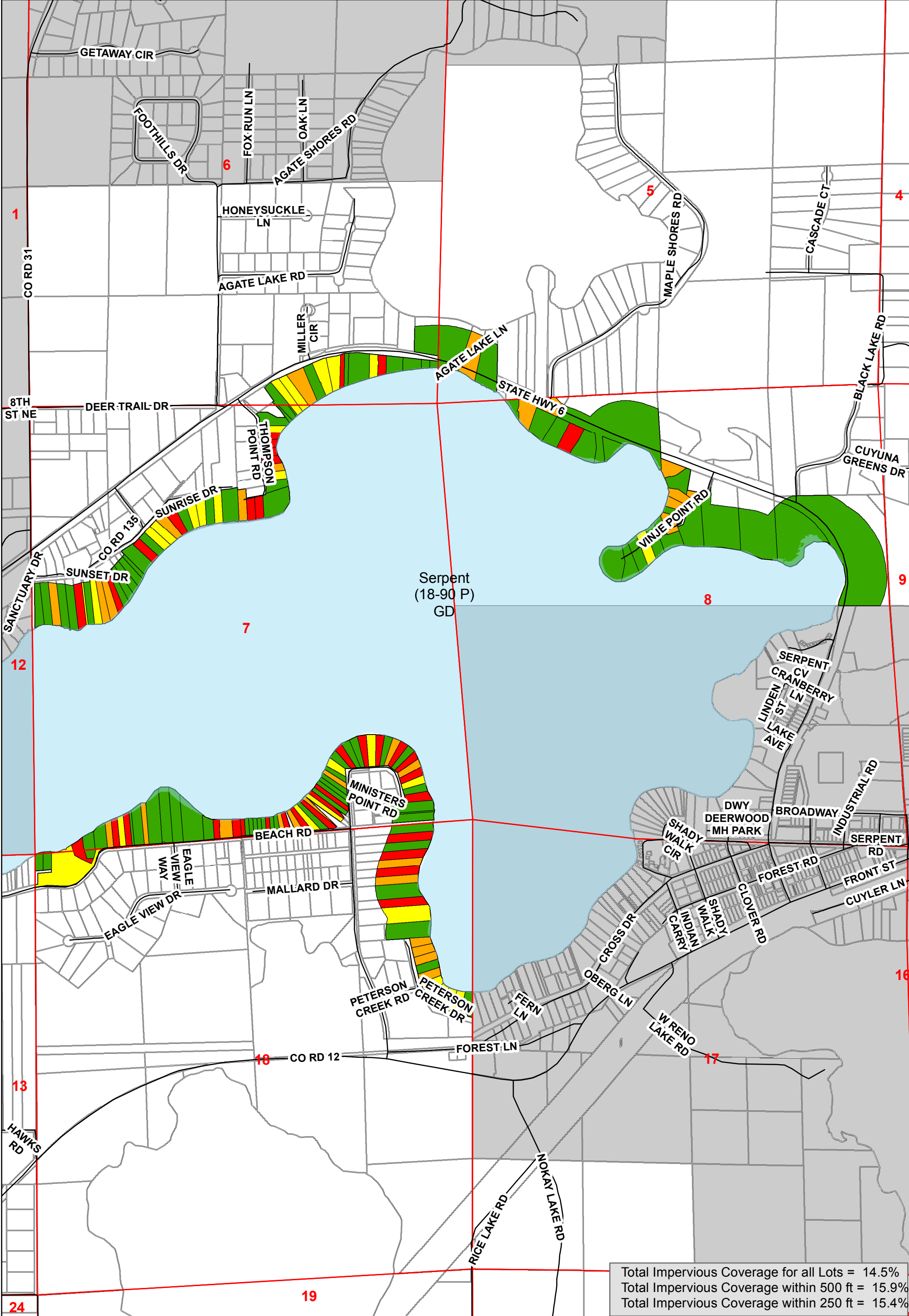
Serpent Lake



Impervious Surface Coverage by Parcel

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |



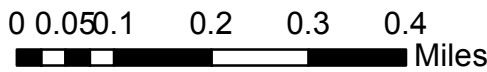


Total Impervious Coverage for all Lots = 14.5%
Total Impervious Coverage within 500 ft = 15.9%
Total Impervious Coverage within 250 ft = 15.4%

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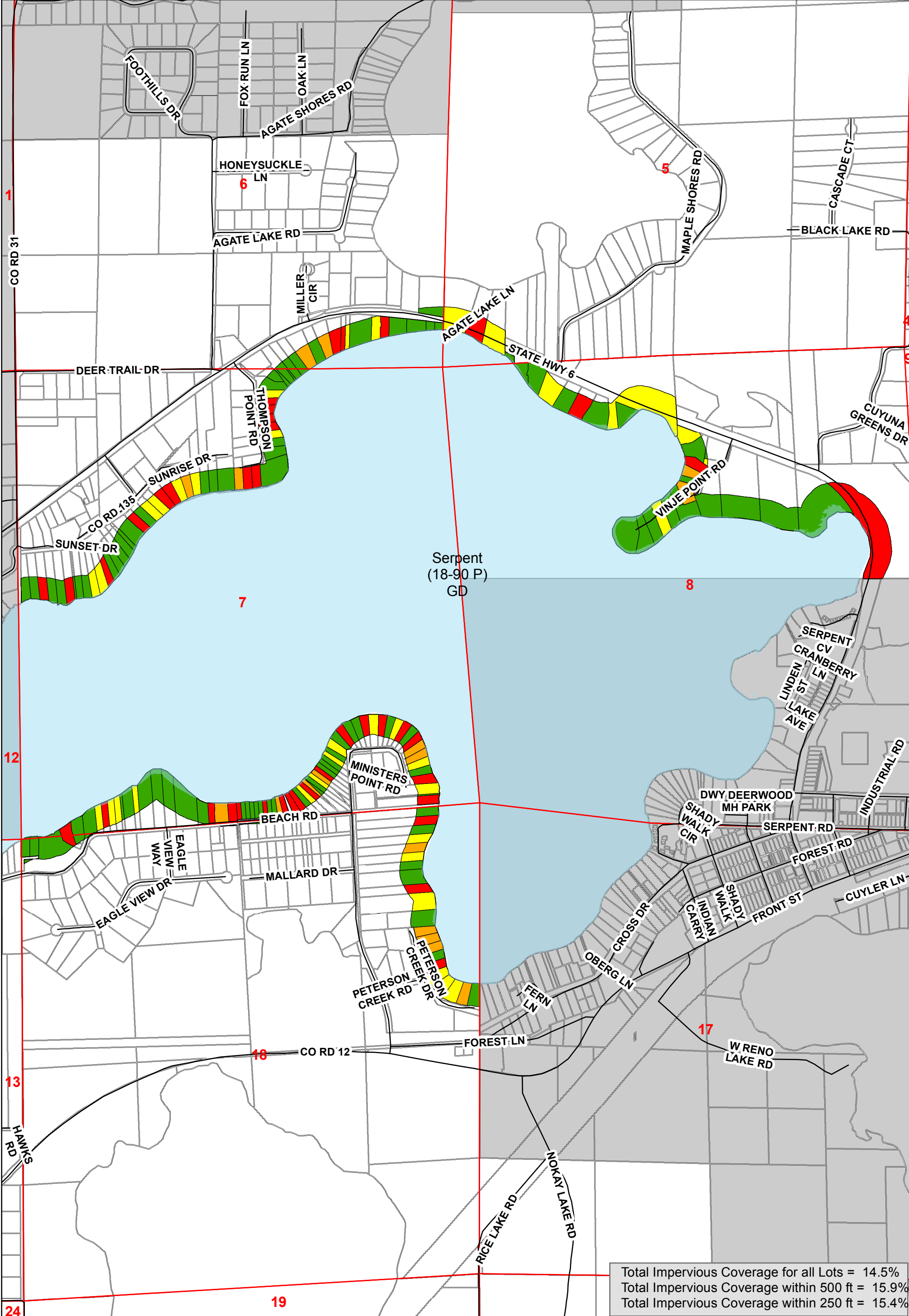


Serpent Lake



Impervious % within 500 ft of Shoreline

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |

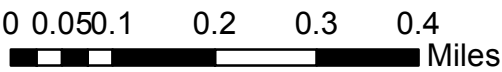


Total Impervious Coverage for all Lots = 14.5%
Total Impervious Coverage within 500 ft = 15.9%
Total Impervious Coverage within 250 ft = 15.4%

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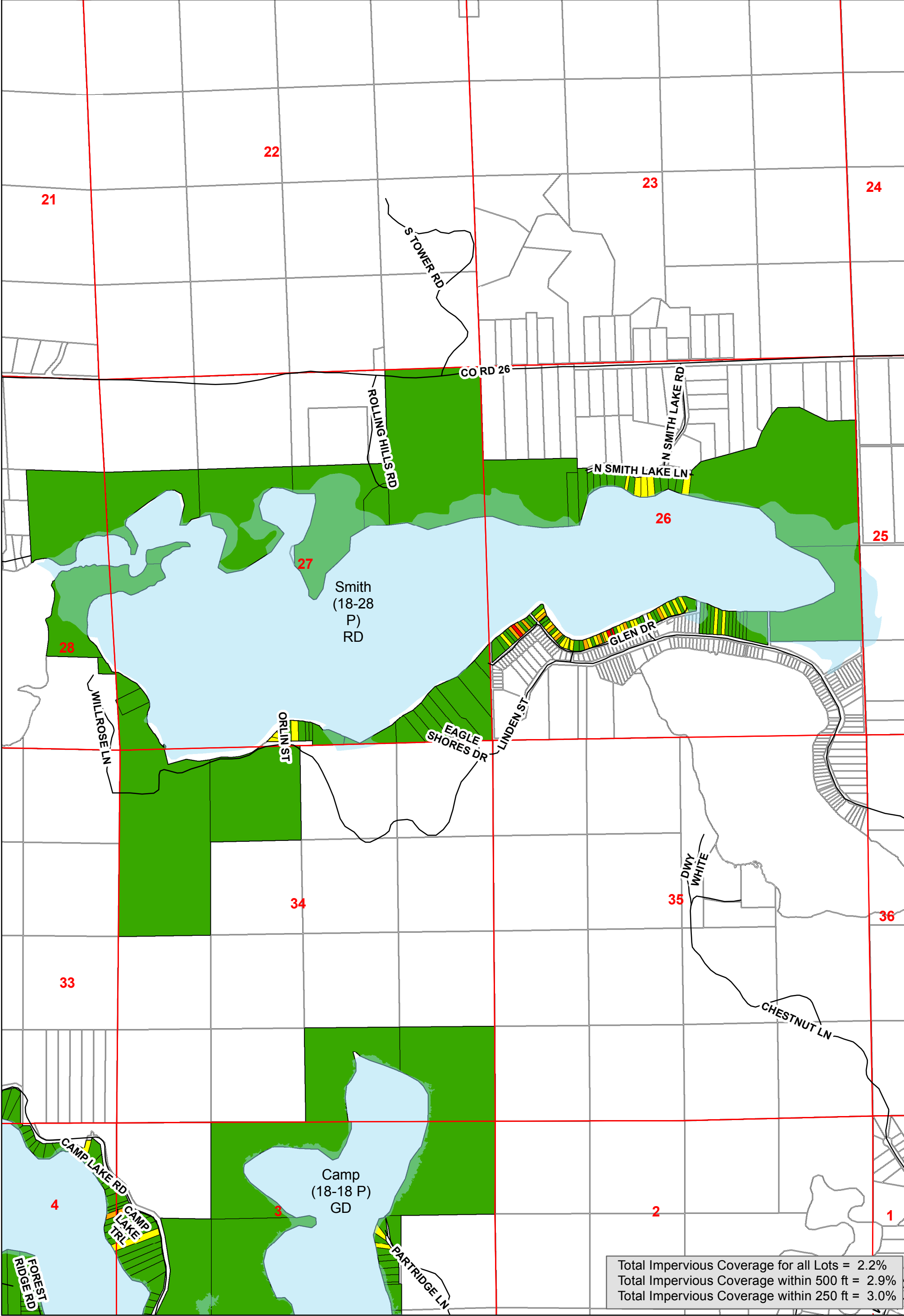
Serpent Lake



Impervious % within 250 ft of Shoreline

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |





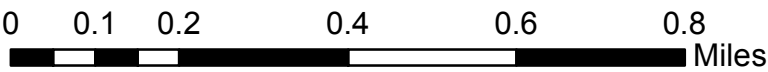
Total Impervious Coverage for all Lots = 2.2%
Total Impervious Coverage within 500 ft = 2.9%
Total Impervious Coverage within 250 ft = 3.0%

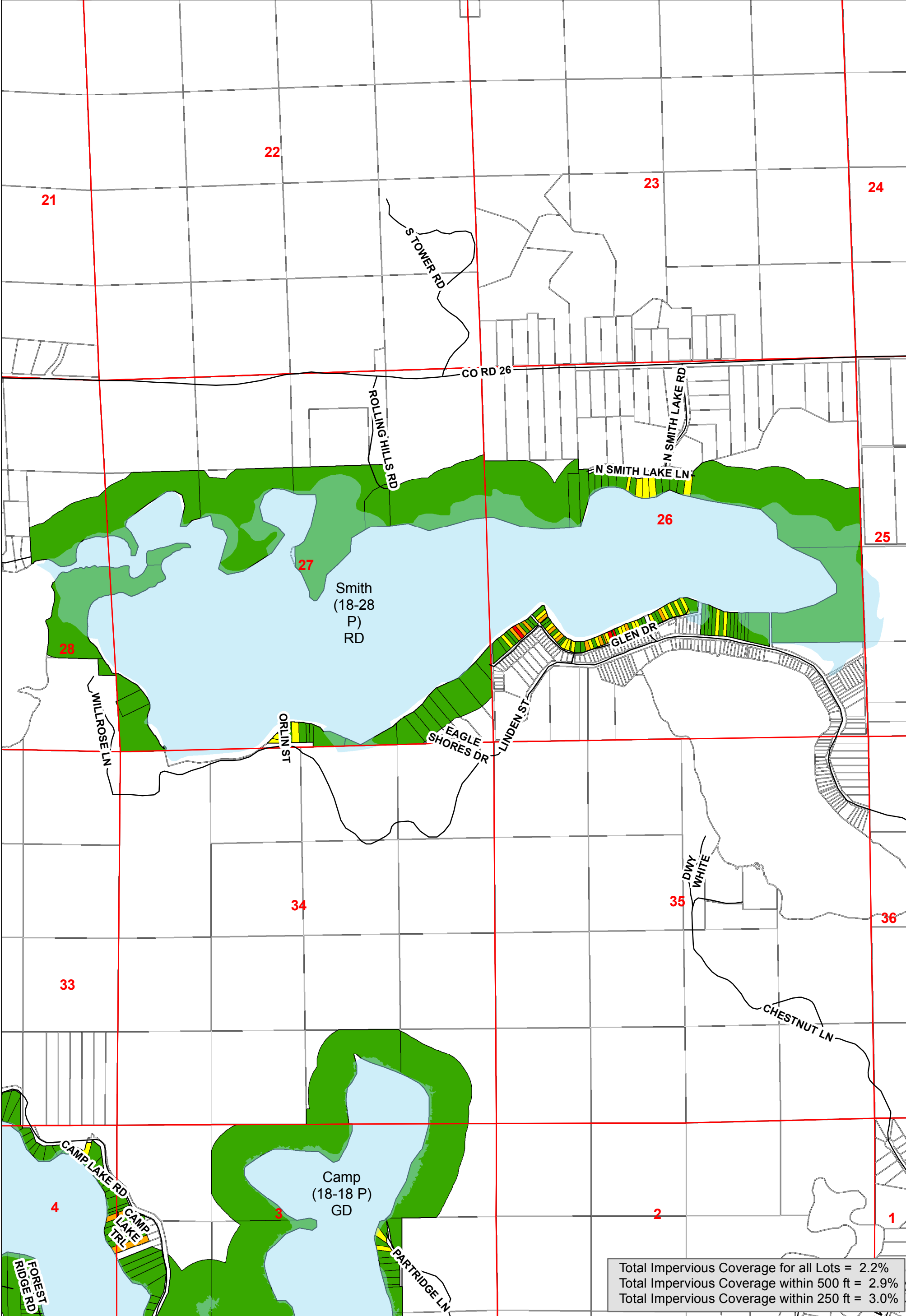
Smith Lake

Impervious Surface Coverage by Parcel

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |

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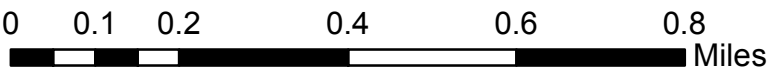


Total Impervious Coverage for all Lots = 2.2%
Total Impervious Coverage within 500 ft = 2.9%
Total Impervious Coverage within 250 ft = 3.0%

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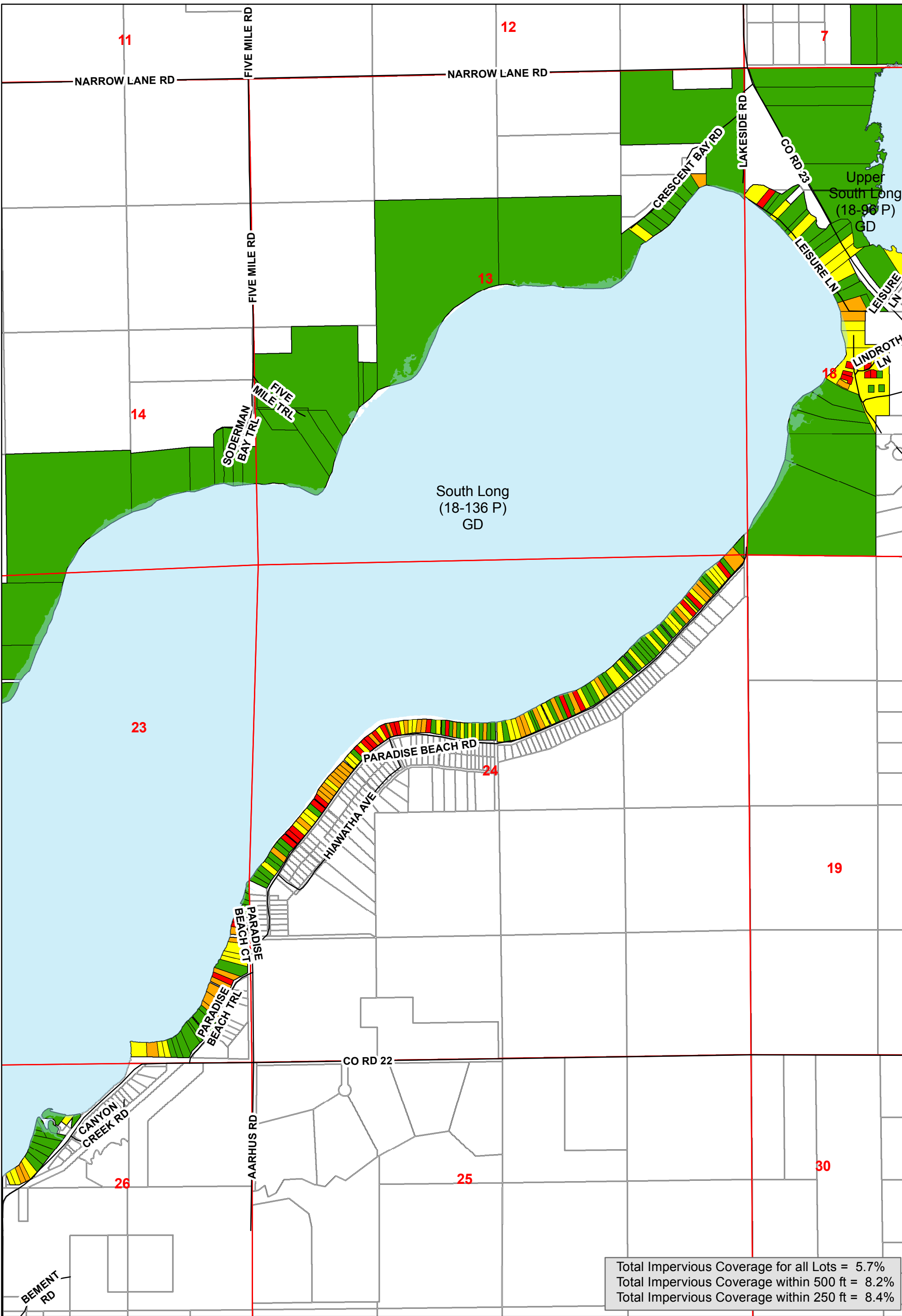


Smith Lake



Impervious % within 500 ft of Shoreline

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |



Total Impervious Coverage for all Lots = 5.7%
Total Impervious Coverage within 500 ft = 8.2%
Total Impervious Coverage within 250 ft = 8.4%

South Long Lake (East)

Impervious Surface Coverage by Parcel

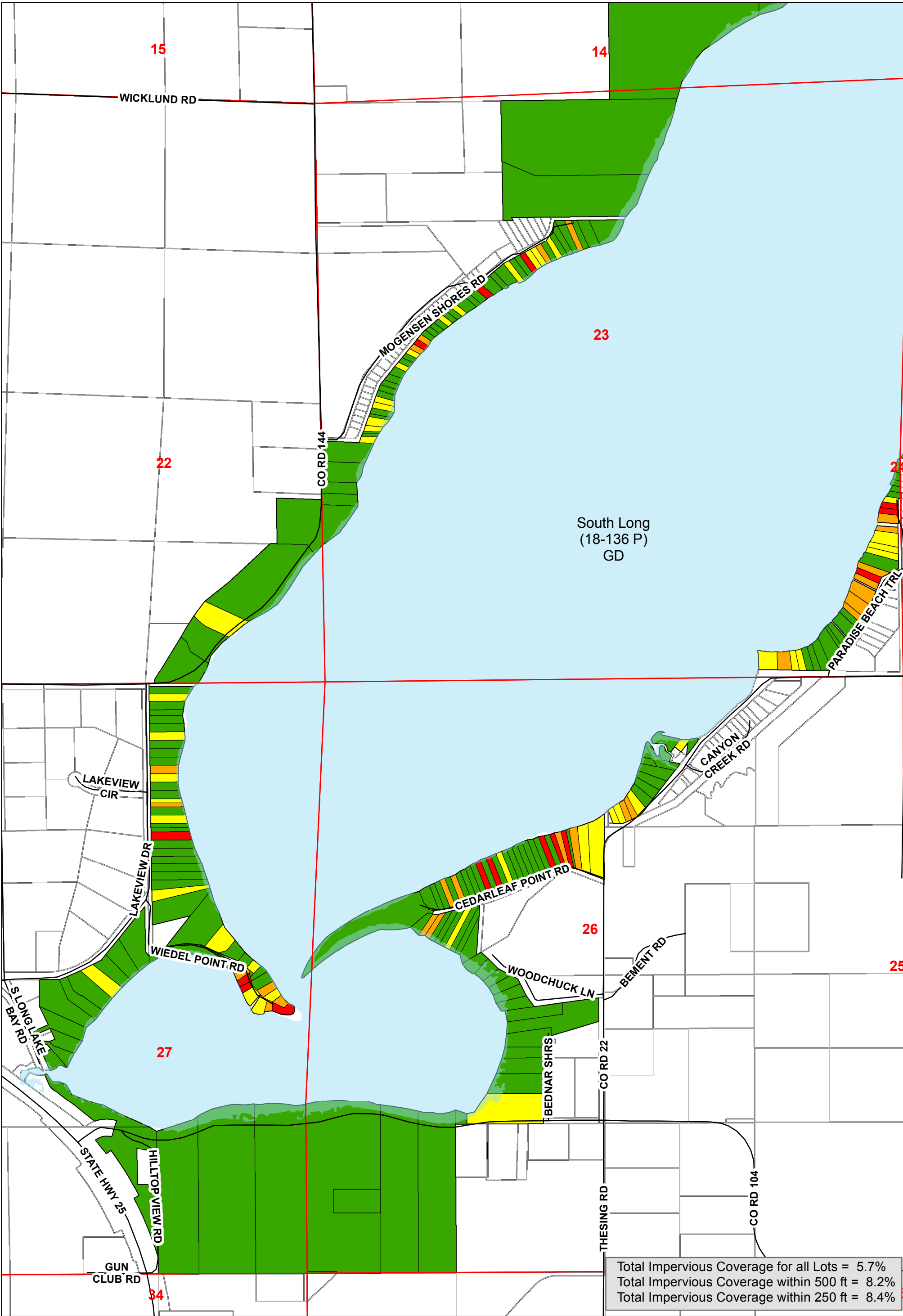
- Roads
- Section Lines
- City
- Parcels
- Lakes
- 0 - 15 %
- 15 - 20 %
- 20 - 25 %
- 25+ %

0 0.050.1 0.2 0.3 0.4 Miles

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CROW WING COUNTY



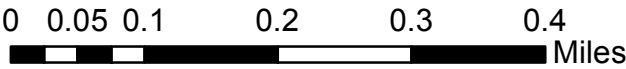
This data is provided on an "AS-IS" basis, without warranty of any type, expressed or implied, including but not limited to any warranty as to their performance, merchantability, or fitness for any particular purpose.



CROW WING COUNTY

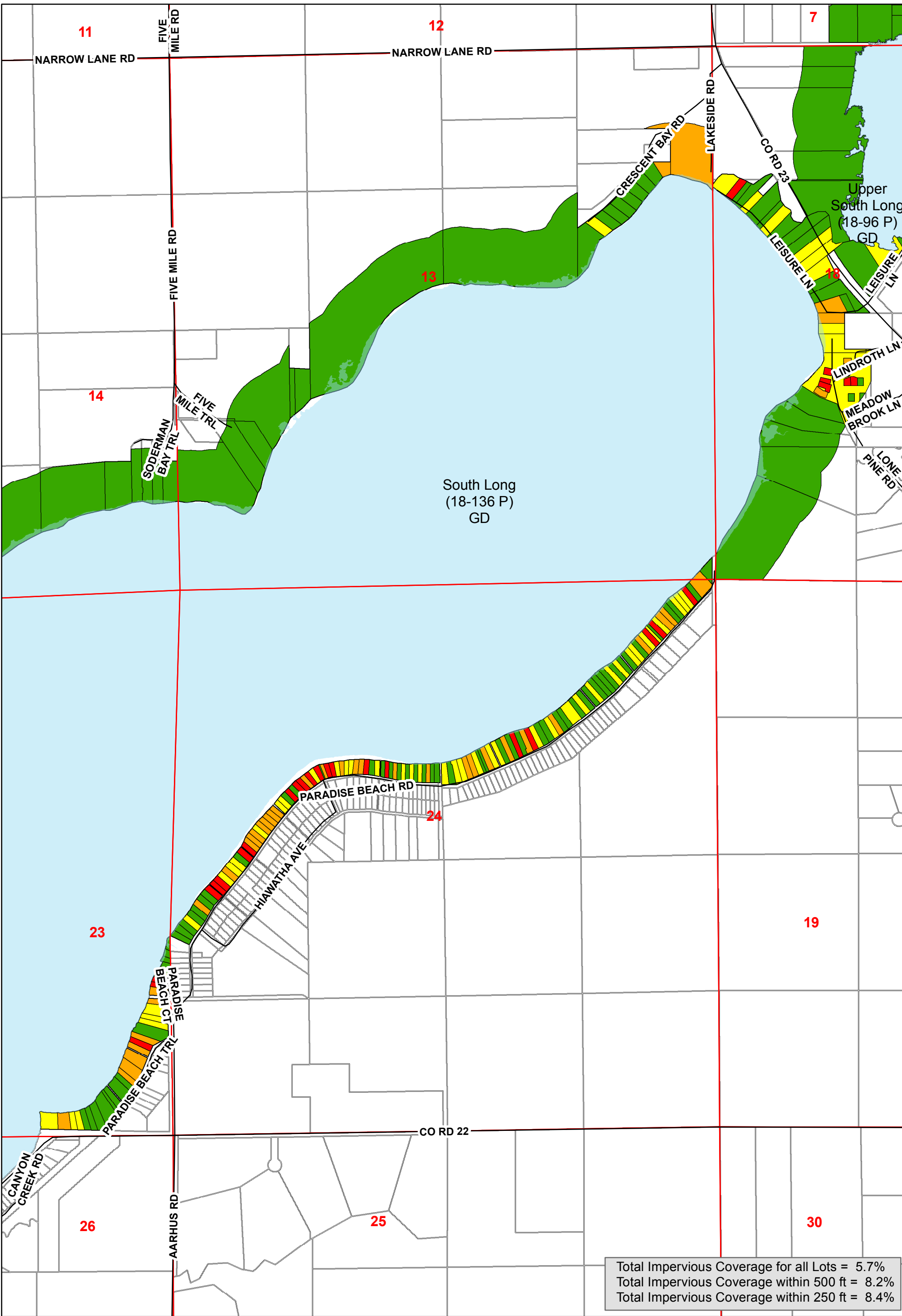


South Long Lake (West)



Impervious Surface Coverage by Parcel

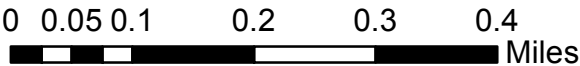
- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |



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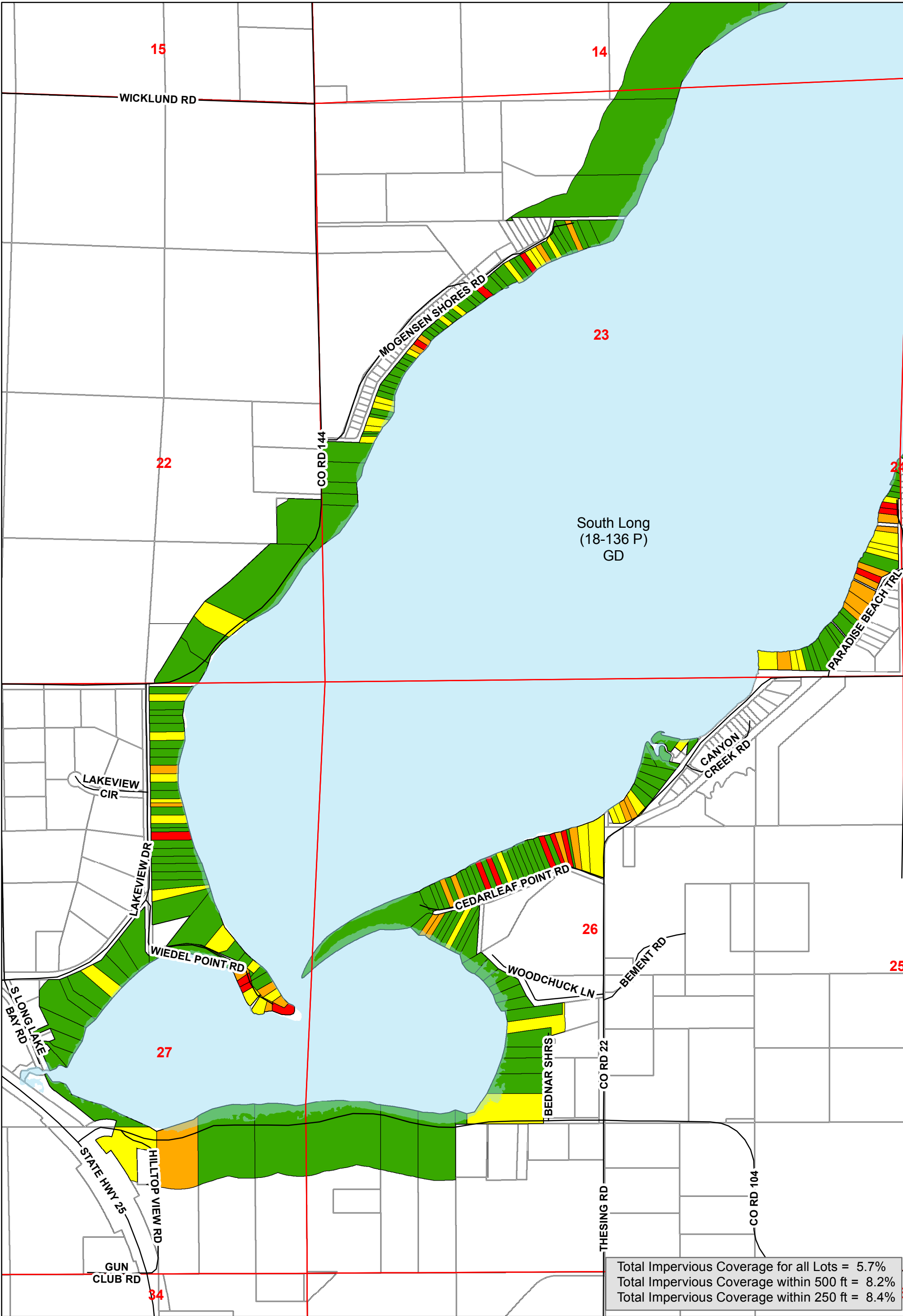
South Long Lake (East)



CROW WING COUNTY

Impervious % within 500 ft of Shoreline

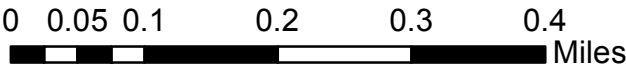
- | | | | |
|---|---------------|---|-----------|
|  | Roads |  | 0 - 15 % |
|  | Section Lines |  | 15 - 20 % |
|  | City |  | 20 - 25 % |
|  | Parcels |  | 25+ % |
|  | Lakes | | |



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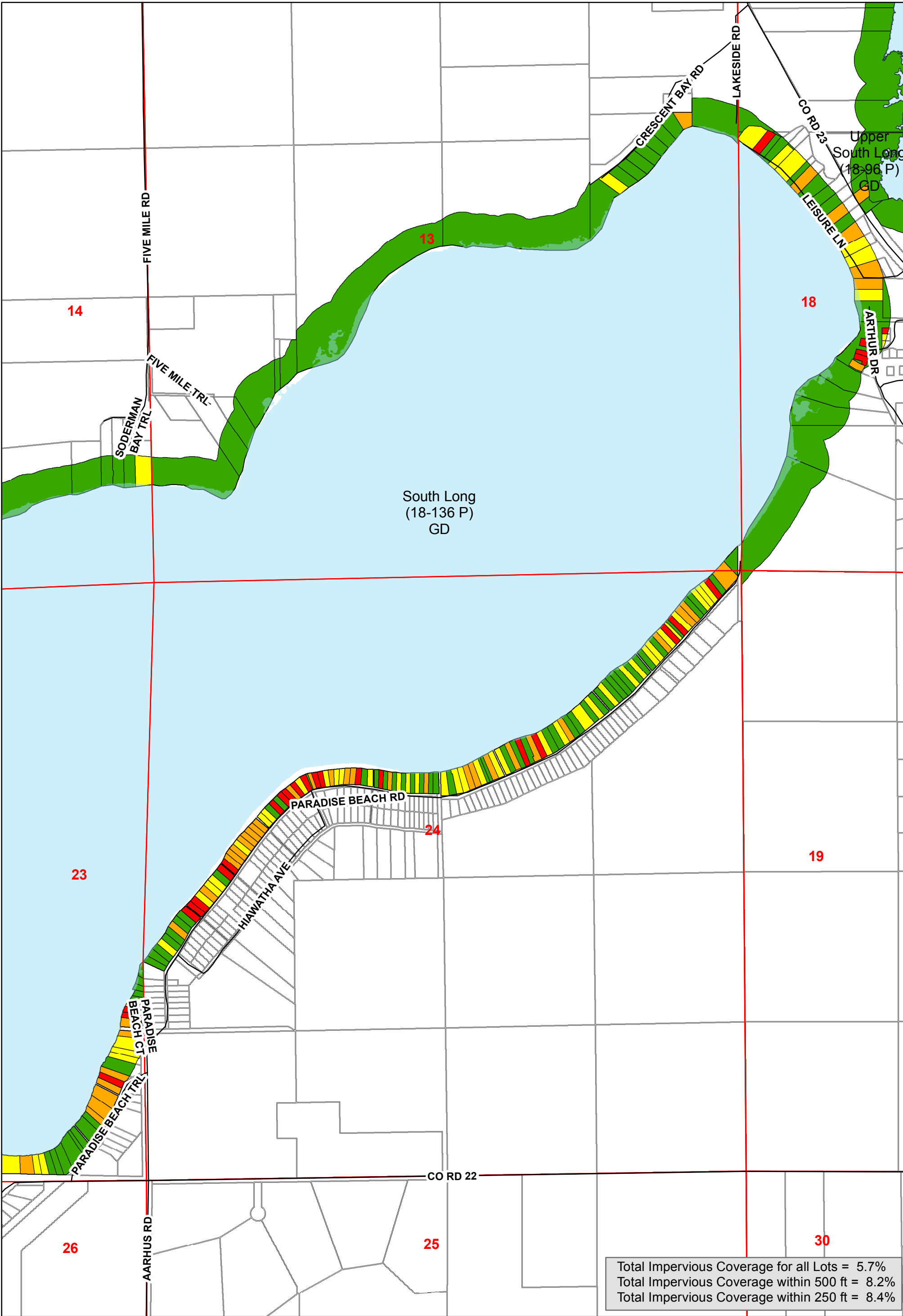
South Long Lake (West)



Impervious % within 500 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |

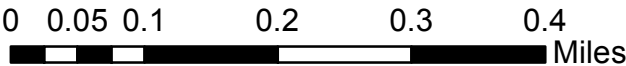




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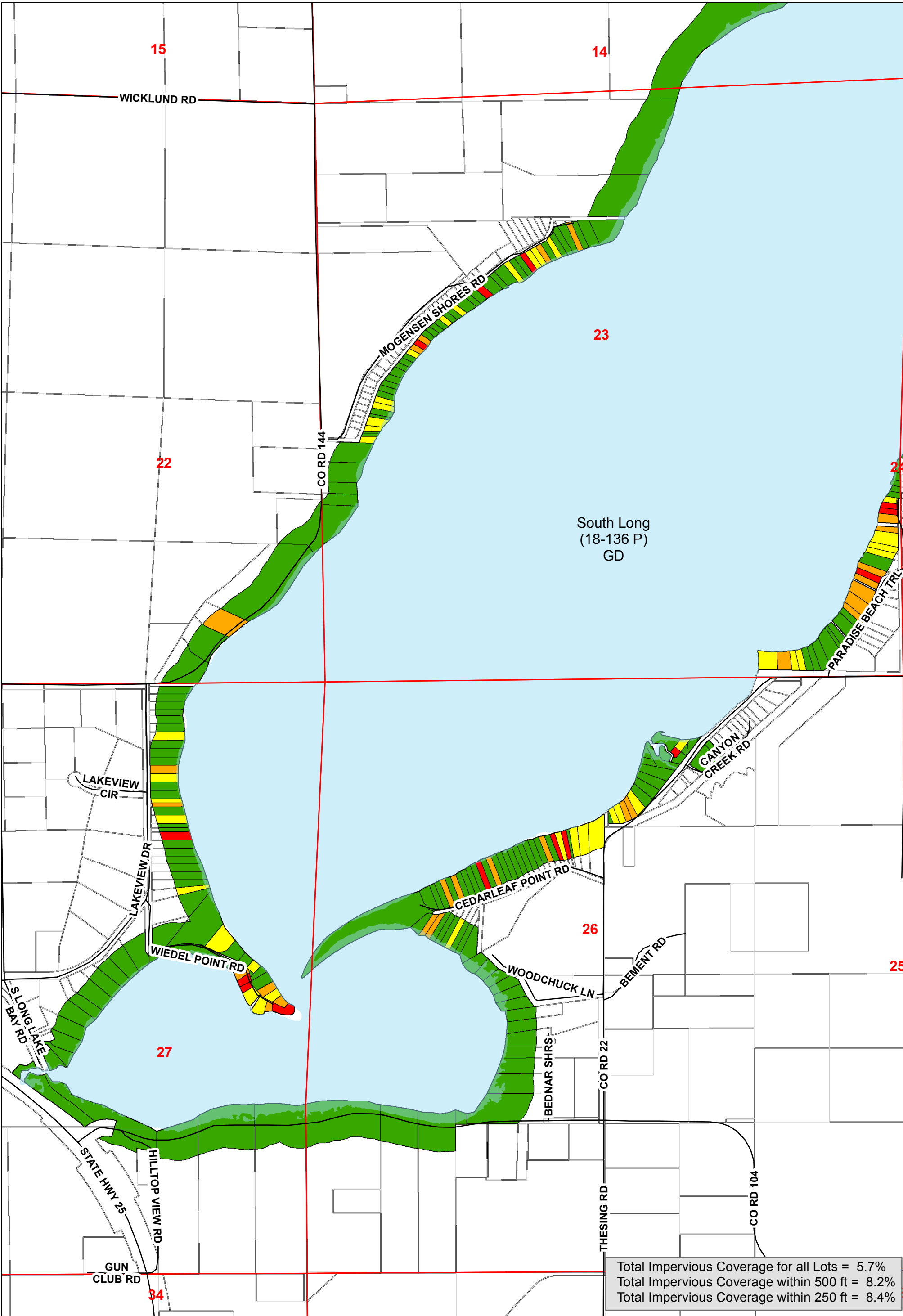
South Long Lake (East)



CROW WING COUNTY

Impervious % within 250 ft of Shoreline

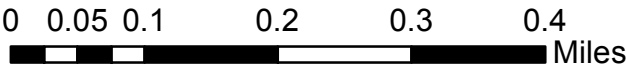
- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |



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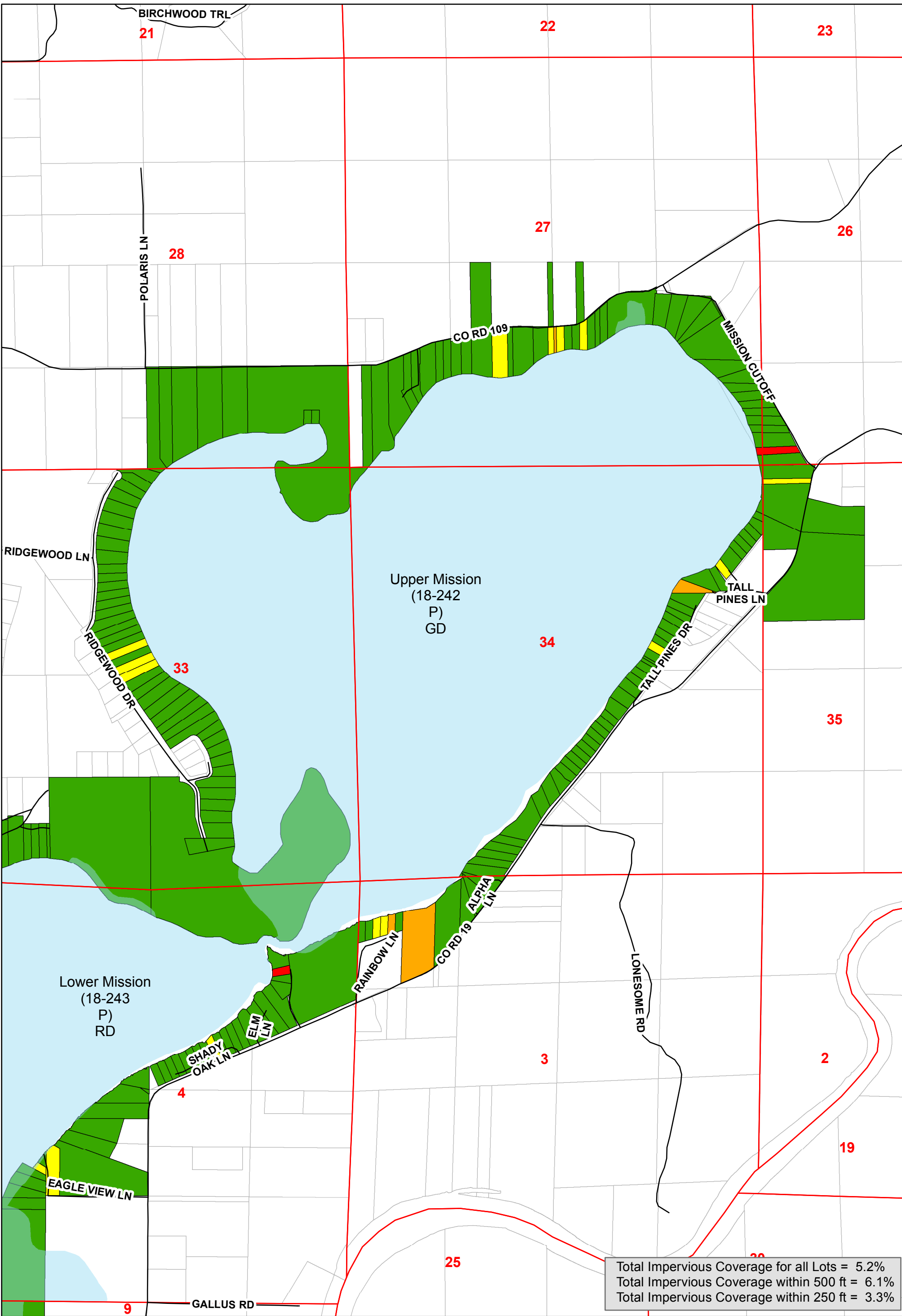
South Long Lake (West)



Impervious % within 250 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |





Total Impervious Coverage for all Lots = 5.2%
Total Impervious Coverage within 500 ft = 6.1%
Total Impervious Coverage within 250 ft = 3.3%

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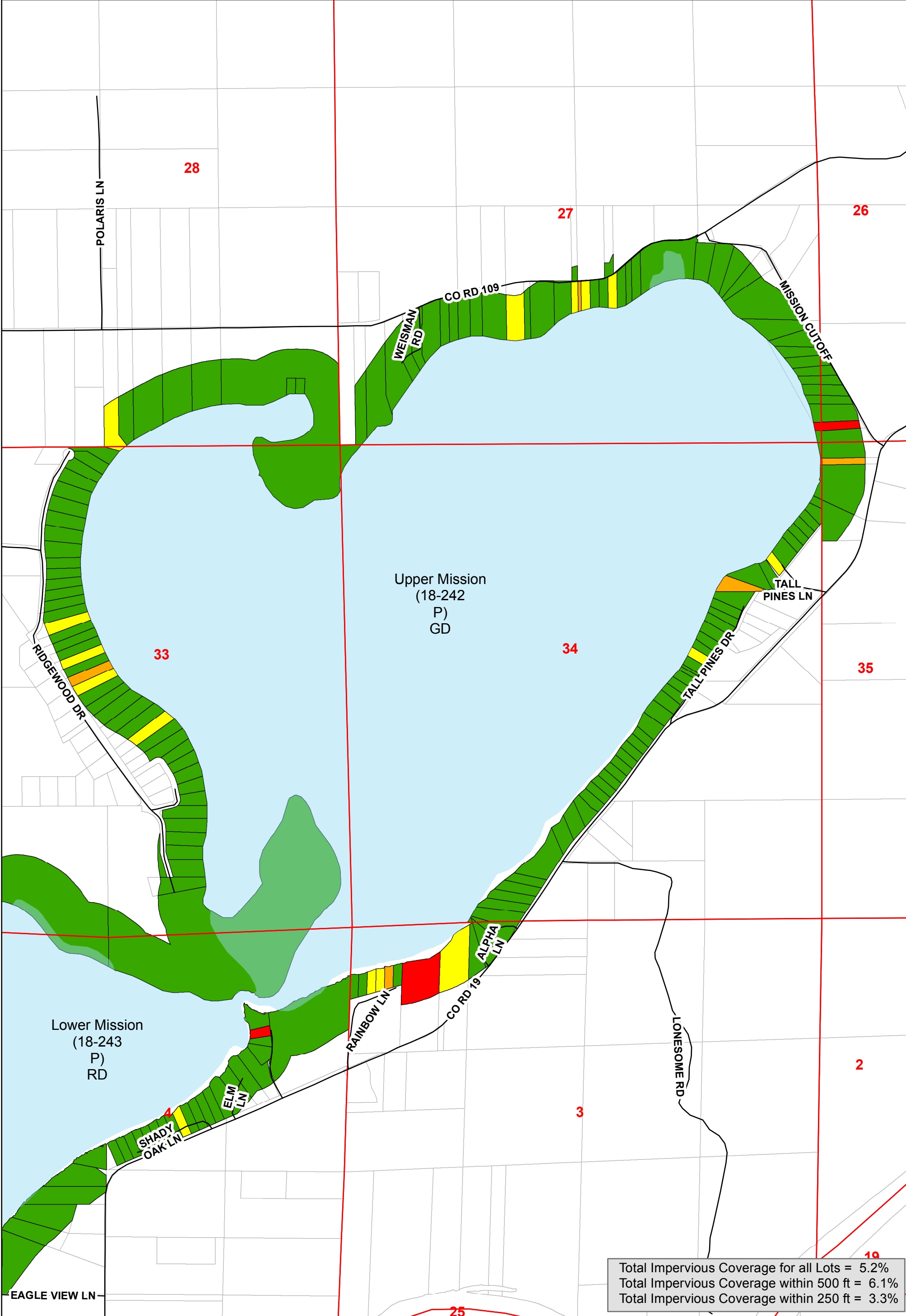


Upper Mission

0 0.05 0.1 0.2 0.3 0.4
Miles



- Impervious Surface Coverage by Parcel**
- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |



Total Impervious Coverage for all Lots = 5.2%
Total Impervious Coverage within 500 ft = 6.1%
Total Impervious Coverage within 250 ft = 3.3%

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0 0.05 0.1 0.2 0.3 0.4
Miles

Upper Mission

Impervious % within 500 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |





Total Impervious Coverage for all Lots = 5.2%
Total Impervious Coverage within 500 ft = 6.1%
Total Impervious Coverage within 250 ft = 3.3%

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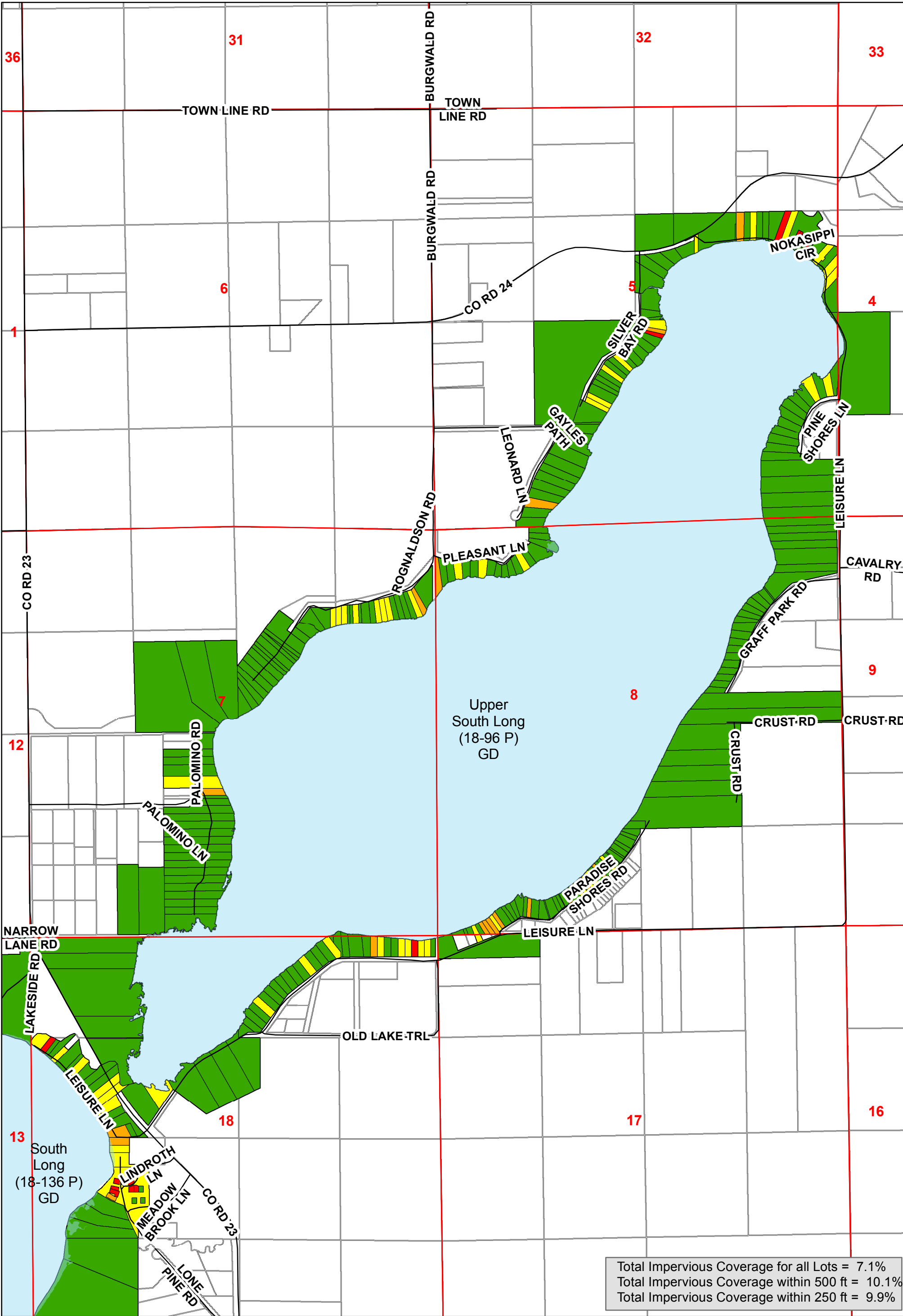
0 0.05 0.1 0.2 0.3 0.4 Miles

Upper Mission

Impervious % within 250 ft of Shoreline

- Roads
- Section Lines
- City
- Parcels
- Lakes





Total Impervious Coverage for all Lots = 7.1%
Total Impervious Coverage within 500 ft = 10.1%
Total Impervious Coverage within 250 ft = 9.9%

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Upper South Long Lake

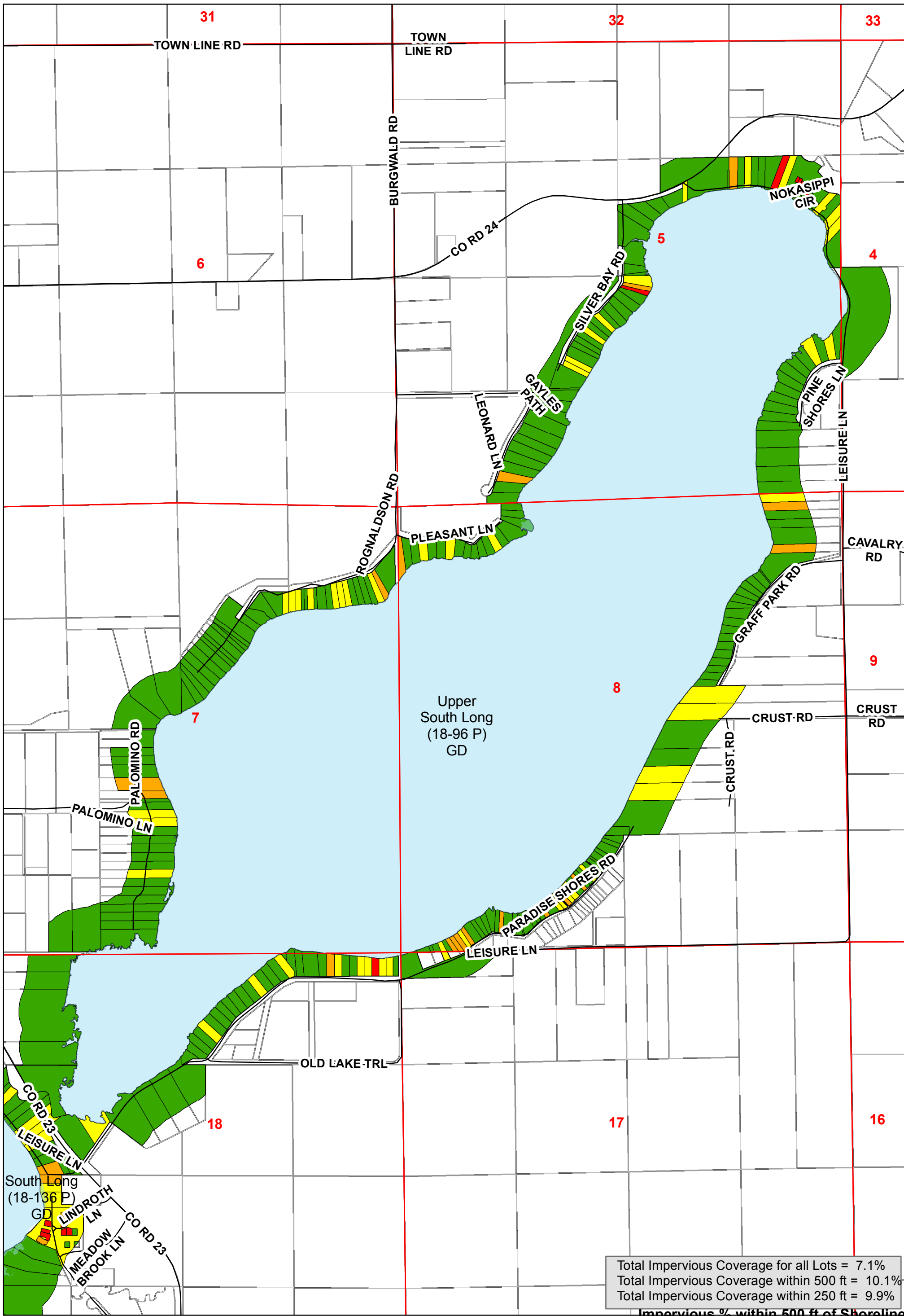
0 0.05 0.1 0.2 0.3 0.4
Miles

Impervious Surface Coverage by Parcel

- | | | | |
|--|---------------|--|-----------|
| | Roads | | 0 - 15 % |
| | Section Lines | | 15 - 20 % |
| | City | | 20 - 25 % |
| | Parcels | | 25+ % |
| | Lakes | | |



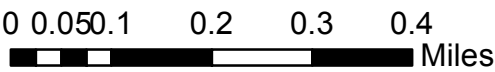
CROW WING COUNTY



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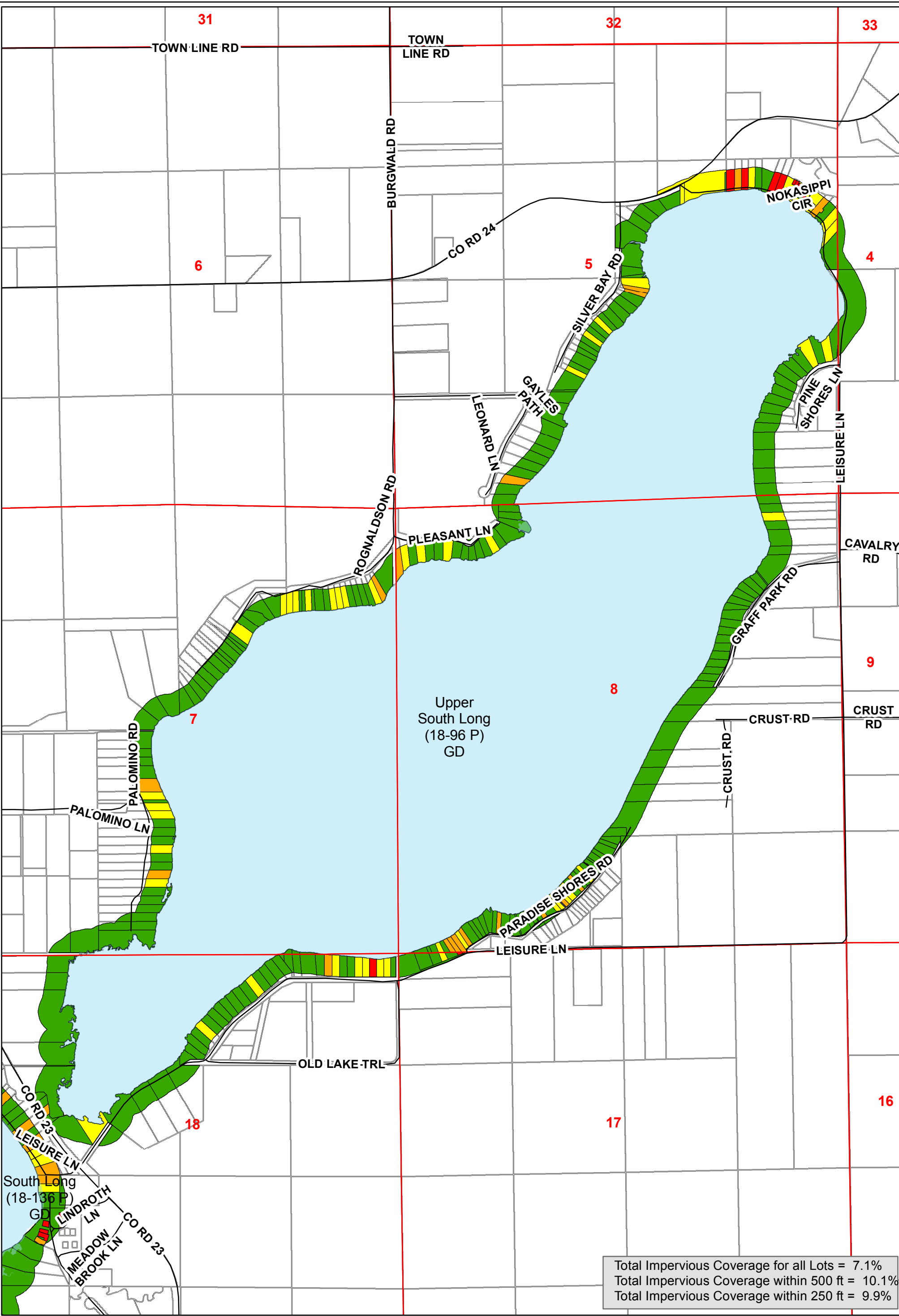


Upper South Long Lake



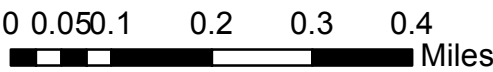
- Roads
- Section Lines
- City
- Parcels
- Lakes
- 0 - 15 %
- 15 - 20 %
- 20 - 25 %
- 25+ %





Total Impervious Coverage for all Lots = 7.1%
Total Impervious Coverage within 500 ft = 10.1%
Total Impervious Coverage within 250 ft = 9.9%

Upper South Long Lake



Impervious % within 250 ft of Shoreline

- | | |
|---------------|-----------|
| Roads | 0 - 15 % |
| Section Lines | 15 - 20 % |
| City | 20 - 25 % |
| Parcels | 25+ % |
| Lakes | |

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